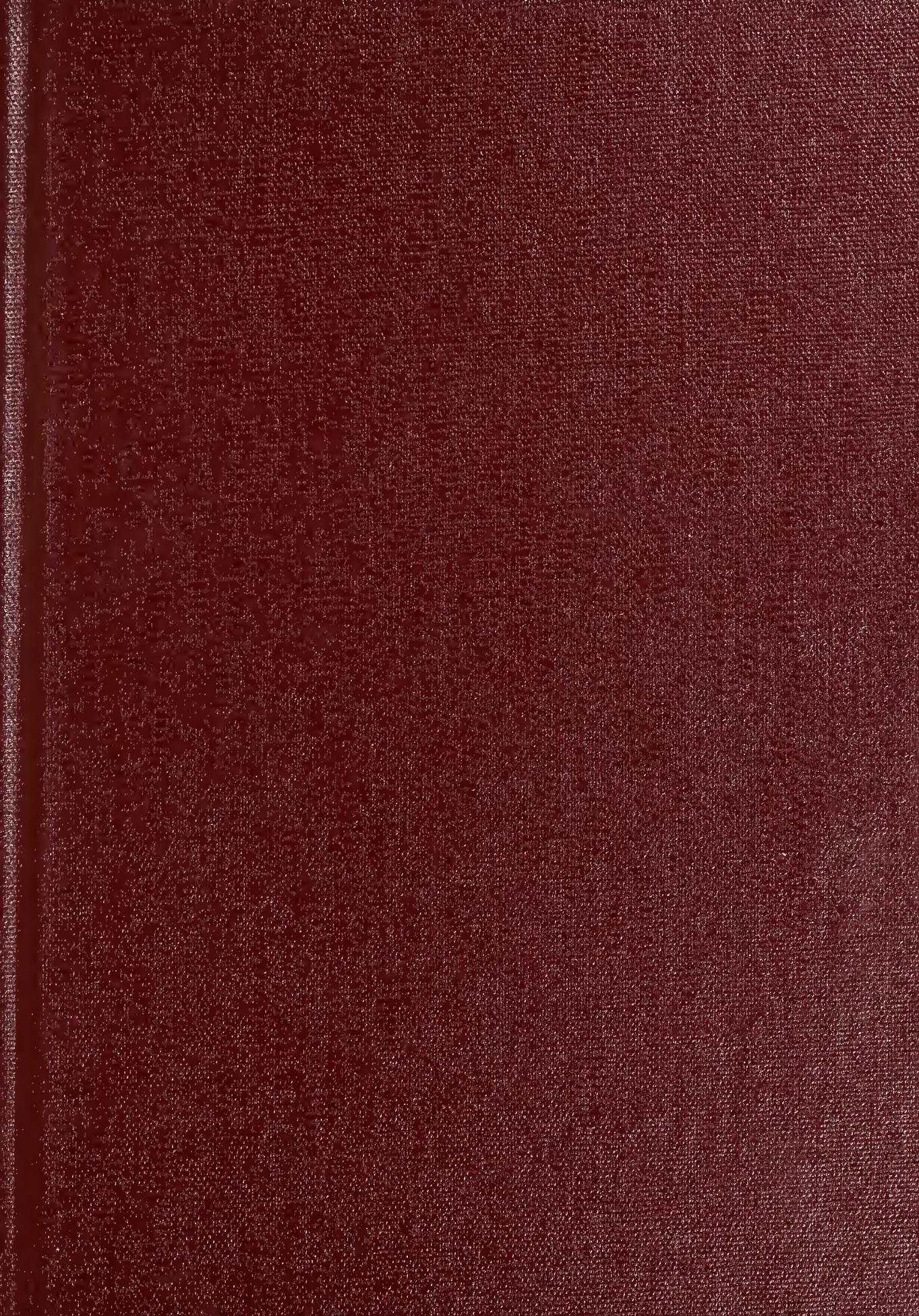


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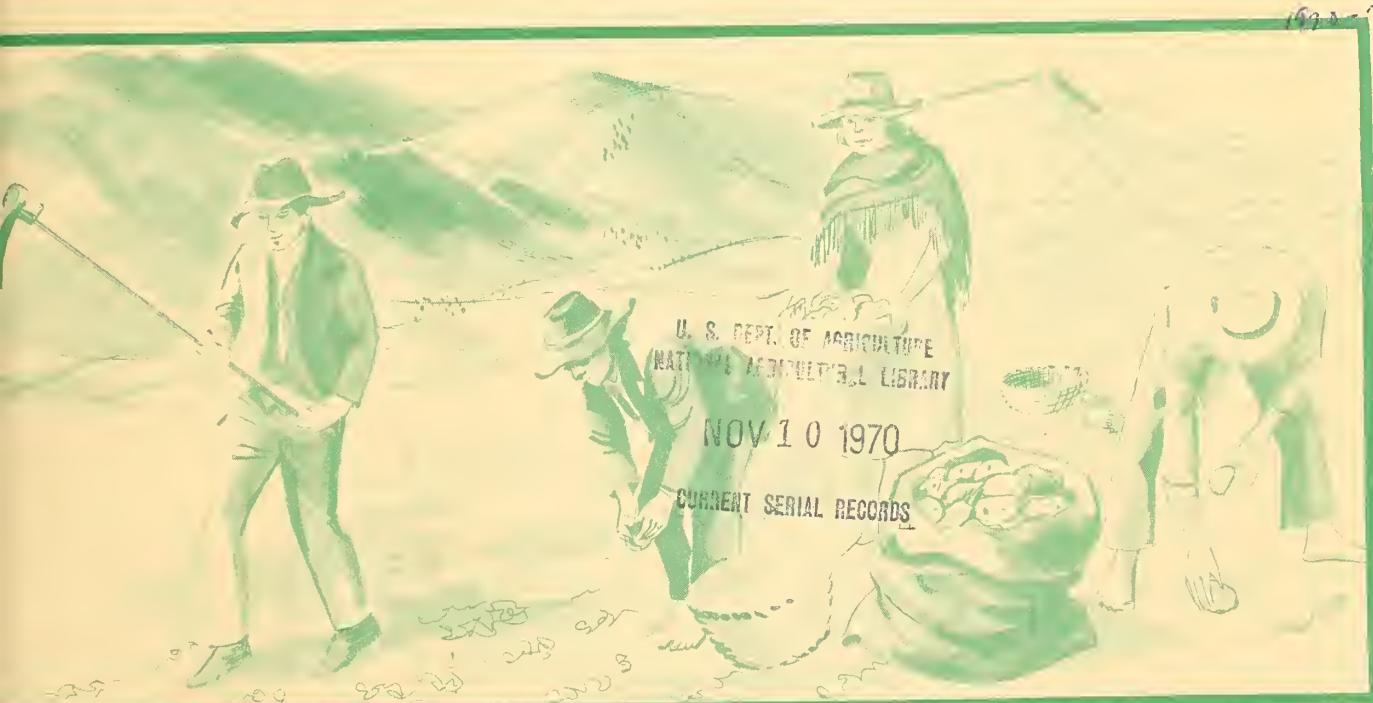


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AGRICULTURAL PRODUCTIVITY IN COLOMBIA

FOREIGN AGRICULTURAL ECONOMIC REPORT NO. 66-19
1970-71



U.S. DEPARTMENT OF AGRICULTURE, ECONOMIC RESEARCH SERVICE, IN COOPERATION WITH
THE MINISTRY OF AGRICULTURE AND THE NATIONAL DEPARTMENT OF PLANNING OF COLOMBIA



ABSTRACT

Colombia's agricultural output rose an average of 3.3 percent annually and total output (GNP) at 4.7 percent annually between 1950 and 1967. Per capita (total) output rose 1.5 percent annually and per capita income 1 percent annually. The proportion of total output from agriculture declined from 40 to 31 percent, whereas manufacturing's share rose from 14 to 18 percent in the 17-year period. Lower coffee prices after 1956 reduced foreign exchange earnings, and economic growth slowed for several years with rising unemployment. The economic outlook improved at the end of the period.

Agricultural productivity increased an average of 1.6 percent annually, and output per person in agriculture rose 2 percent annually. Increases in area and yields were largest for crops produced with mechanization, especially cotton, rice, and sugarcane grown on large farms adopting improved practices. Broader participation in output expansion could be obtained by stressing selected nontraditional inputs. Special measures are needed to help small farmers expand and modernize.

Key Words: Colombia, agricultural production, agricultural productivity, crop yields, prices, nontraditional inputs, technological progress.

Throughout this report, tons are metric tons. Also, the following equivalents have been used: 1 hectare (ha.) = 2.471 acres and 6.90 pesos in 1958 = US\$1.

Washington, D. C. 20250

October 1970

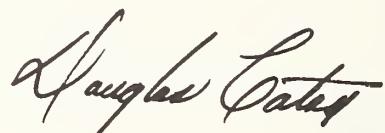
FOREWORD

To provide better knowledge for planning and implementing development programs in the less developed countries, the Agency for International Development asked the Economic Research Service of the U.S. Department of Agriculture to study the factors associated with differences and changes in agricultural production in underdeveloped countries.

Phase 1 of the research has been completed, and was reported in Changes in Agriculture in 26 Developing Nations, 1948-63 (Foreign Agr. Econ. Rpt. No. 27, Economic Research Service, U.S. Department of Agriculture, Nov. 1965). In phase 2 of the research, specific relationships between factors and processes of change in agricultural output were studied in selected countries: Greece, Taiwan, Mexico, Brazil, Colombia, India, and Nigeria.

This is the second and final part of the detailed study on Colombia. Part I was published as Changes in Agricultural Production and Technology in Colombia (Foreign Agr. Econ. Rpt. No. 52, Economic Research Service, U.S. Department of Agriculture, June 1969).

Part II, reported here, examines the relationship between agriculture and the general economy and influences affecting agricultural production and productivity. Price relationships and contributions of nontraditional inputs are considered. The study concludes with an analysis of the conditions affecting rates of change in the various sectors of agriculture and offers suggestions for accelerating development.



Senior Agricultural Adviser
Bureau of Technical Assistance
Agency for International Development

ACKNOWLEDGMENTS

The compilation and selection of the historical statistics in this report was a joint effort by many agencies. Their generosity in providing the latest available estimates and in answering questions and giving advice and suggestions is gratefully acknowledged.

Tabulations were assembled and collated by Lula White, Foreign Development and Trade Division (FDTD), Economic Research Service, (ERS). Major contributions were made by Lucía Cruz de Schlesinger, María Teresa Berry, Nohyra Mosquera, and Nubia de la Roche, Colombian economists employed in this project. Throughout the course of the study, Tomás López, of the Colombian Ministry of Agriculture, gave direct help.

Several members of the U.S. staff of the Agency for International Development in Bogotá were helpful, notably Norman Ward and Kenneth McDermott. Albert Berry of the Yale University Economic Growth Center made available a draft of his unpublished book on the development of Colombian agriculture.

Wade F. Gregory, formerly Chief of the Economic Development Branch, FDTD, ERS, who directed the broader project, collaborated in the overall planning and negotiating for this study and at every stage contributed valuable suggestions.

Helpful criticisms of preliminary drafts were made by Richard G. Wheeler, formerly of ERS; Lawrence W. Witt, Michigan State University; Dale W. Adams, Ohio State University; John H. Sanders, Minnesota University; Herman Felstehausen, University of Wisconsin Land Tenure Center; Peter Hildebrand, Nebraska Mission in Colombia; and Brian Perkins, Harvard Mission. As would be expected, none of these are responsible for any errors or shortcomings of this report nor should it be assumed that they agree with all of the conclusions.

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SUMMARY

Although agricultural output has expanded less rapidly than nonagricultural production in Colombia since 1950, development of the two sectors appears consistent, with neither lagging in relation to the other. Colombia's announced policy to industrialize and to get away from dependence upon agriculture, especially upon coffee, has resulted in more Government help for industry than for agriculture. Nevertheless, the discriminatory effects upon agriculture have been less significant than the general effects arising from economic management and policy.

Total output advanced at an average annual rate of 4.7 percent between 1950 and 1967. Population growth accelerated from 2.5 percent to 3.3 percent during the period. Per capita rates of growth of output and income varied, but for the whole period averaged 1.5 percent annually for output and 1 percent for income.

Throughout the 17-year period, industrial production grew more rapidly than agriculture. In terms of the proportion of total output at constant factor prices, agriculture declined from 40 to 31 percent, whereas manufacturing industries rose from 14 to 18 percent.

As in many developing countries, rural migration to cities has been substantial. In 1950, the rural population accounted for 62 percent of the total population. In 1966, it was less than half.

A sharp rise in import demand for raw materials and intermediate products accompanied the development of factory industry. The most rapidly growing industries depended heavily on imports. This made manufacturing production particularly vulnerable to import restrictions, which were imposed from time to time. With a smaller foreign component than manufacturing, agriculture was less affected by such restrictions on imported goods.

A slowing down in the rate of industrial development during most of the 1960's was accompanied by rising unemployment. Agriculture as well as manufacturing had progressed more rapidly during the earlier period of import substitution than in the subsequent development of foreign markets. Near the end of the 1960's, however, there was a marked improvement in economic performance and prospects, accompanied by monetary, fiscal, and exchange reform. Although political uncertainty developed over the 1970 presidential election, the economy was continuing to improve.

Agricultural productivity -- that is, total output per unit of input -- increased at an average annual rate of 1.6 percent during 1950-67. The number of persons employed in agriculture increased a little more than 1 percent annually, compared with a rate of increase of a little over 3 percent annually for total farm output. Thus, output per person rose at an average annual rate of 2 percent. Production of major crops rose 3.15 percent annually; a little more than half of the increase is attributable to increased area and the remainder, to higher yields. The principal yield increases were in commercial crops that are produced with relatively modern technology, with little change occurring in yields of traditional crops. For most commercial crops, yields

were somewhat higher on large farms than on small farms (according to a special tabulation for 1966).

Agricultural prices have risen at about the same rate as nonagricultural prices since 1950 -- a little slower if coffee is included, and a little faster if it is excluded.

Progress was made in transportation and education during 1950-67, but rural education remained deficient, with two-thirds of rural schools offering instruction only through the second grade and most of the rest through the third grade.

Progress in agriculture was very uneven, with good gains for selected crops -- especially cotton, rice, and sugarcane for sugar -- and for poultry and eggs. Most of the increase in crop production was associated with mechanization on relatively large farms in fertile river valleys. Much of the land in these large farms is rented. Yields on these farms were increased with better seeds, pesticides, and fertilizer. For small farmers, a series of obstacles plus limitation of size restricted expansion and modernization through the use of nontraditional inputs. Special programs have helped some small farmers, however, and an increase in such assistance will broaden the area of expansion and modernization to more of these farmers.

AGRICULTURAL PRODUCTIVITY IN COLOMBIA

by

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INTRODUCTION

Part I of the agricultural productivity study of Colombia described changes in that country's agricultural production and technology over the past two decades. It is briefly summarized below. 1/

The first chapter of this final report on Colombia examines the relationships between agriculture and the rest of the economy with emphasis upon general policies and developments that have affected each sector. The second chapter provides estimates of agricultural productivity based upon the relationship between total inputs and total output of crops and livestock and livestock products. The third analyzes farm and nonfarm price relationships and evaluates the performance of farm prices. The fourth presents the record of Colombia's experience with nontraditional agricultural inputs--pesticides, fertilizers, improved seeds, and farm machinery. The fifth summarizes the role of education, transportation, and other community facilities in development. The sixth chapter examines characteristics associated with variations in technological progress by type of farming and offers suggested changes that would accelerate progress. This report is based on annual data for 1950-67, and some preliminary data for 1968 and 1969.

Summary of Part I -- Foreign Agricultural Economics Report No. 52

Agricultural production in Colombia increased rather steadily at an average annual rate of 3.3 percent during 1950-67. This rate was about equal to the rate of population growth, so that production per capita showed little change. Food production for domestic consumption also increased at about the same rate as total agricultural production, and food supplies per capita were stable, falling a little below recommended international nutritional standards.

Somewhat more than half of the increase in agricultural production was attributable to increased area, with wide variation in the growth in output per hectare during different parts of the period and among the various crops.

Production of cotton, sugarcane, and rice expanded most, because of increased area under cultivation and higher yields per hectare. These crops were cultivated with relatively modern technology and were grown on farms much

1/ Readers who wish more details as a background for the present study may obtain copies of Changes in Agricultural Production and Technology in Colombia (Foreign Agr. Econ. Rpt. 52, June 1969) from the Office of Management Services, U.S. Department of Agriculture, Wash., D. C. 20250.

larger than peasant holdings. Production increased little for crops grown principally under traditional culture on small farms.

Output of livestock and livestock products rose somewhat faster than crop output, but in a pronounced cyclical pattern. Although efforts have been made to increase beef production for export, per capita cattle slaughter has declined in recent years as traditional production methods on ranches were slow to change. In contrast, poultry and egg production increased rapidly with adoption of modern technology.

For the purpose of considering production first and productivity changes second, crops were classified into groups, as follows:

1. Coffee;
2. Traditional culture -- plantains, panela (noncentrifugal sugar), yuca (cassava), and beans;
3. Mixed culture -- corn, potatoes, tobacco, and wheat;
4. Plantation-type tree crops--- bananas and cocoa;
5. Mechanized crops, major -- cotton, rice, and sugarcane; and
- 5A. Mechanized crops, other -- sesame, soybeans, grain sorghum, and barley.

CHAPTER I--DEVELOPMENT OF THE COLOMBIAN ECONOMY
AND THE ROLE OF AGRICULTURE

Although expansion in agriculture after 1950 was less rapid than in industry, development of the two sectors appears to have been consistent, with neither being outstanding nor neglected and with neither being a bottleneck in relation to the other. Colombia's announced policy of industrializing and diverting from dependence on agriculture, especially on coffee, has resulted in more Government assistance to industry than to agriculture. Nevertheless, the discriminatory effects on agriculture appear to have been less serious than the effects of the country's general economic management and policy. In addition, there has been the indirect effect of a slowly growing demand per capita for agricultural products (27). 2/

In general, total rates of expansion in industry and in agriculture have been relatively favorable. But, with rapid population growth, per capita rates of expansion have been lower than anticipated by Colombians and others. 3/

It is important, however, to distinguish between the historical record of the period of 1950-67 and the situation at the end of the 1960's. The historical record is disappointing, especially because the period began so well and, when progress slowed, the country enlisted international enthusiasm and promise of support for recovery and expansion programs. Such programs were not fulfilled, for complex reasons, and a crisis situation developed in 1965-66.

Then came an important change. Reforms adopted toward the end of 1966 and early 1967 were followed by good progress in 1968 and 1969, partly as a result of fortuitous developments. As a consequence, improved prospects and outlook prevailed at the beginning of the 1970's. Little of this new optimism was foreshadowed in the events of the preceding two decades.

Development of the Colombian Economy, 1950-67

Total output advanced rather steadily between 1950 and 1967, at an average annual rate of 4.7 percent. With the acceleration in population growth from a little less than 2.5 percent annually near the beginning of the period to about 3.3 percent at the end of the period, the rate of growth of output per capita eased somewhat in the later years (tables 1 and 2). 4/

2/ Underscored numbers in parentheses refer to items in Literature Cited, p. 99.

3/ Although the rapid rate of population growth converts a rather impressive rate of total output expansion into a weak rate of growth in output and income per capita, it should not be inferred that the population growth has had a wholly negative effect upon the economic development of Colombia. The accounting is easy, but the causal relationship between population and economic growth is not well understood. Nevertheless, the rapid and accelerating population growth represents a major problem.

4/ Information on population was obtained in a personal interview with Alvaro López, CEDE, Universidad de los Andes, Bogotá.

Table 1.--Total and per capita real gross domestic product and national income at 1958 prices, Colombia, 1950-67

| Year : | Real GDP | Real national income | Per capita GDP 1/ | Per capita real national income 1/ |
|---------|---------------|----------------------|-------------------|------------------------------------|
| | Million pesos | | Pesos | |
| 1950... | 14,688.8 | 12,791.7 | 1,268 | 1,104 |
| 1951... | 15,146.6 | 12,744.8 | 1,277 | 1,074 |
| 1952... | 16,102.0 | 13,571.1 | 1,324 | 1,116 |
| 1953... | 17,081.0 | 14,881.6 | 1,369 | 1,189 |
| 1954... | 18,262.3 | 16,404.7 | 1,425 | 1,280 |
| 1955... | 18,976.1 | 16,212.0 | 1,441 | 1,231 |
| 1956... | 19,745.7 | 16,761.4 | 1,457 | 1,237 |
| 1957... | 20,186.2 | 16,679.3 | 1,445 | 1,194 |
| 1958... | 20,682.5 | 16,480.8 | 1,435 | 1,143 |
| 1959... | 22,176.9 | 17,487.1 | 1,492 | 1,176 |
| 1960... | 23,123.4 | 18,246.3 | 1,506 | 1,188 |
| 1961... | 24,300.2 | 19,131.3 | 1,533 | 1,207 |
| 1962... | 25,615.3 | 20,173.1 | 1,565 | 1,232 |
| 1963... | 26,457.2 | 20,756.6 | 1,564 | 1,227 |
| 1964... | 28,088.8 | 22,883.7 | 1,607 | 1,309 |
| 1965... | 29,100.0 | 23,491.1 | 1,611 | 1,300 |
| 1966... | 30,658.2 | 24,825.0 | 1,643 | 1,330 |
| 1967... | 31,947.0 | 25,749.0 | 1,658 | 1,336 |

1/ Estimates of population figures obtained from Alvaro López in personal interview.

Source: Banco de la República, Colombia, Cuentas Nacionales, 1950-67.

Table 2.--Total and per capita rates of growth of gross domestic product, Colombia, 1950-67

| Period | Total GDP growth rate | Per capita GDP growth rate |
|--------------|-----------------------|----------------------------|
| | Percent | |
| 1950-51..... | 3.12 | .71 |
| 1951-52..... | 6.30 | 3.68 |
| 1952-53..... | 6.08 | 3.40 |
| 1953-54..... | 6.92 | 4.09 |
| 1954-55..... | 3.91 | 1.12 |
| 1955-56..... | 4.06 | 1.11 |
| 1956-57..... | 2.23 | -.82 |
| 1957-58..... | 2.46 | -.69 |
| 1958-59..... | 7.22 | 3.97 |
| 1959-60..... | 4.27 | .94 |
| 1960-61..... | 5.09 | 1.79 |
| 1961-62..... | 5.41 | 2.09 |
| 1962-63..... | 3.29 | -.06 |
| 1963-64..... | 6.17 | 2.75 |
| 1964-65..... | 3.60 | .25 |
| 1965-66..... | 5.35 | 1.99 |
| 1966-67..... | 4.20 | .91 |

Source: Banco de la República, Colombia, Cuentas Nacionales, 1950-67.

Per capita growth was substantial during the early 1950's, but negligible for a few years thereafter (1954-58). In subsequent years (1959-67), per capita growth resumed, at a rate about half as fast as in the early 1950's with occasional pauses. For the 17-year period as a whole, per capita gross domestic product (GDP) increased at an average annual rate of 1.5 percent (fig. 1).

Real national income provides another useful measure of growth. In addition to being an income concept instead of a gross output measure (that is, adjusted for depreciation), it is also adjusted for foreign exchange loss or gain attributable to price changes (in Colombia, chiefly changes in coffee prices). Real income per capita rose more rapidly than output per capita during 1952-54, but then showed a substantial decline through 1958. Thereafter, recovery was relatively slow, and a full decade elapsed after the 1954 peak before real per capita income again reached the earlier high. Thus, there was not a sustained rise in income throughout 1950-67, but in 1967 real per capita income was about one-fifth higher than in 1950. (The least squares fitted line indicates an annual growth rate averaging nearly 1 percent.)

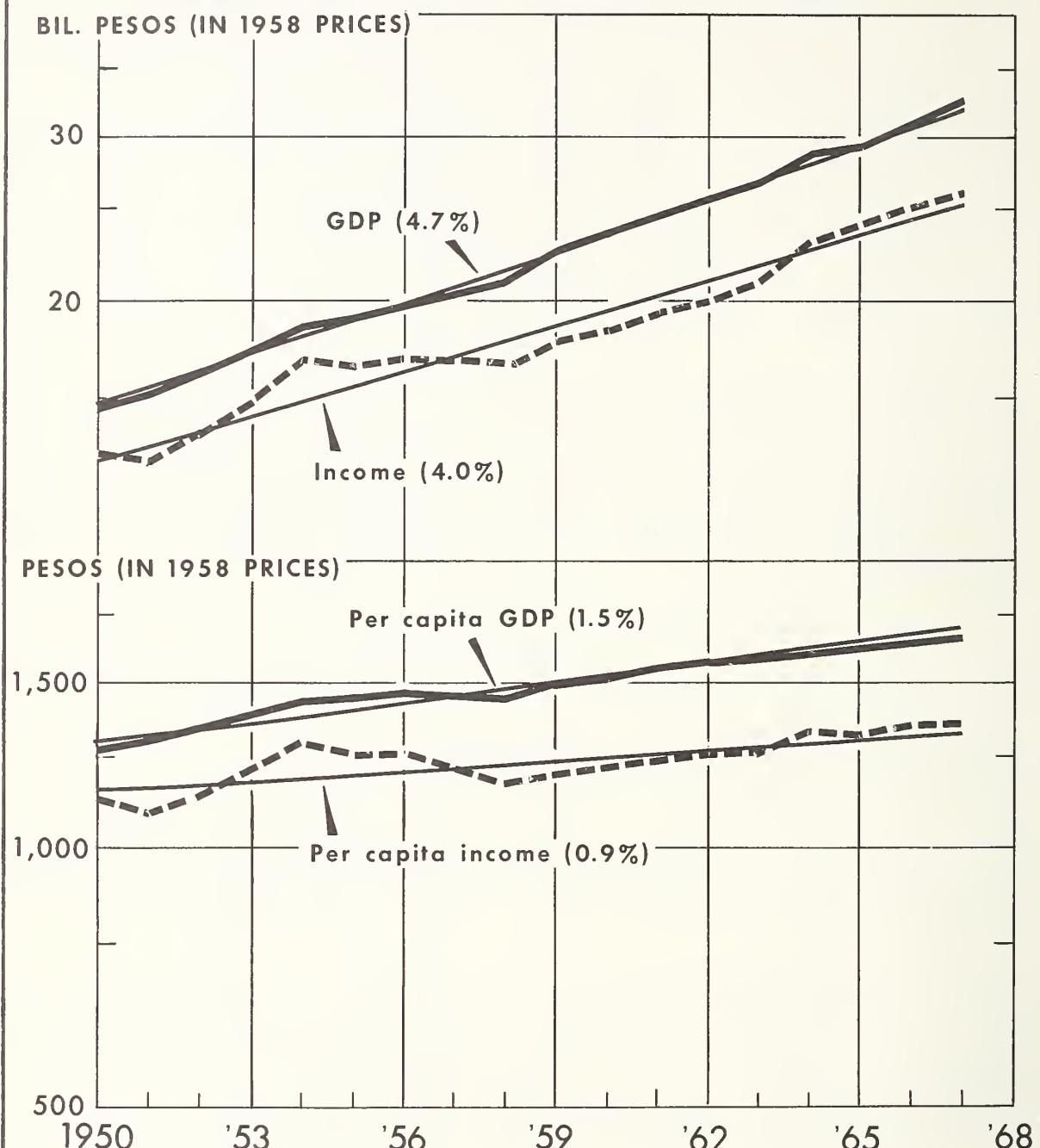
Industrial production grew more rapidly than agriculture throughout the 17-year period. In terms of the proportion of total output at constant factor prices, agriculture declined from 40 to 31 percent, whereas manufacturing industries rose from 14 to 18 percent (table 3). This much-noted shift is a well-known characteristic of economic development; it is an illustration of the consistent growth of agriculture and industry, which (in the spirit of Hirschman) may be a secondary trait rather than the primary goal of rapid growth, however unbalanced (20).

Like agriculture, manufacturing has developed a strong dualism in Colombia. In the relatively modern sector, value added per person employed is high. But in a group of traditional handicraft industries, value added per person is even lower than the average for agriculture. Value of production is about five times as high in the factory group as in the handicraft group, although employment, at 5.3 percent of the labor force, is slightly lower (29). Industrial and agricultural modernization in Colombia has been a slow process, becoming significant only after World War II. The modern subsectors were formed by new industries which used roughly the same technology as that in developed countries. Use of capital-intensive methods was largely unavoidable, since the development of a new technology is extraordinarily difficult. Nevertheless, it has meant a relatively small increase in employment in these industries.

As in many developing countries, rural migration to cities has been substantial in Colombia. Rural population in centers of 1,500 or less accounted for 62 percent of the total population in 1950. By 1966, fewer than half lived in rural areas. Initially, the movement to the cities was a main consequence of political outbursts, with farmers seeking protection against the violence in the countryside. Later, wage differentials and better living conditions caused large increases in the urban labor force.

A sharp rise in import demand for raw materials and intermediate products accompanied the development of factory industry. The most rapidly growing industries have depended most heavily on imports. They have been particularly vulnerable to import restrictions imposed from time to time. With a smaller

TOTAL AND PER CAPITA REAL GROSS DOMESTIC PRODUCT AND REAL NATIONAL INCOME IN COLOMBIA



SOURCE: BANCO DE LA REPUBLICA, COLOMBIA, CUENTAS NACIONALES, 1950 - 67.

U.S. DEPARTMENT OF AGRICULTURE

NEG. ERS 7846-70 (8) ECONOMIC RESEARCH SERVICE

Figure 1

Table 3.--Agricultural, industrial, and total gross domestic product at 1958 constant factor cost,
Colombia, 1950-67

| Year | Total GDP | Agricultural GDP 1/ | | | | Manufacturing GDP | | | |
|------|-----------|---------------------|----------------|-----------------------------|-----------------------|-------------------|----------------|-----------------------|-----------------------|
| | | Mil. | Value pesos | Percentage of total GDP: | | Mil. pesos | Value pesos | Percentage change: | |
| | | | | Pct. | Value of total GDP | | | Pct. | Value of total GDP |
| 1950 | 13,754.2 | 5,506.3 | 40.0 | | 1,914.2 | | | | 13.9 |
| 1951 | 14,177.3 | 5,572.5 | 39.3 | | 1,974.1 | | | | 13.9 |
| 1952 | 15,070.3 | 5,952.8 | 39.5 | | 2,111.1 | | | | 14.0 |
| 1953 | 15,940.8 | 5,968.1 | 37.4 | | 2,298.5 | | | | 14.4 |
| 1954 | 16,994.1 | 6,125.5 | 36.0 | | 2,507.7 | | | | 14.8 |
| 1955 | 17,675.6 | 6,276.8 | 35.5 | | 2,673.5 | | | | 15.1 |
| 1956 | 18,407.6 | 6,472.0 | 35.2 | | 2,866.9 | | | | 15.6 |
| 1957 | 18,842.2 | 6,869.4 | 36.5 | | 2,996.0 | | | | 15.9 |
| 1958 | 19,311.0 | 7,086.1 | 36.7 | | 3,127.0 | | | | 16.2 |
| 1959 | 20,672.5 | 7,441.9 | 36.0 | | 3,381.6 | | | | 16.4 |
| 1960 | 21,522.0 | 7,447.8 | 34.6 | | 3,587.3 | | | | 16.7 |
| 1961 | 22,605.3 | 7,740.1 | 34.2 | | 3,799.0 | | | | 16.8 |
| 1962 | 23,818.2 | 7,995.4 | 33.6 | | 4,056.2 | | | | 17.1 |
| 1963 | 24,591.5 | 8,040.5 | 32.7 | | 4,247.5 | | | | 17.3 |
| 1964 | 26,083.4 | 8,492.3 | 32.6 | | 4,495.8 | | | | 17.2 |
| 1965 | 26,998.1 | 8,487.2 | 31.4 | | 4,704.9 | | | | 17.4 |
| 1966 | 28,415.2 | 8,770.0 | 30.9 | | 5,013.6 | | | | 17.6 |
| 1967 | 29,744.4 | 9,190.6 | 30.9 | | 5,193.3 | | | | 17.5 |

1/ Excludes fishing, hunting, and forestry.

Source: Banco de la República, Colombia, Cuentas Nacionales, 1950-67.

import component than manufacturing, agriculture has been less affected by such restrictions.

In turn, the slowing down in the rate of development of the industrial sector has been reflected in the small number of jobs this sector has been able to offer to the increasing numbers of people entering the labor force each year. Total employment has risen considerably more slowly than the labor force in recent years. Slighton, in 1968, estimated that unemployment in the larger cities of Colombia was about 14 percent, and approximately 10 percent for the country as a whole (29). These percentages indicate much higher unemployment than in earlier years (11). A survey for Colombia's national planning department estimated that unemployment was 13.5 percent in 1969. No estimates have been made of rural unemployment.

In general, agriculture as well as manufacturing seemed to progress more rapidly during the earlier period of import substitution (see below) than in the period of development of foreign markets. It was easier to produce for a market in which quality standards are loose and, though costs may be higher, protection is provided from competition of foreign products.

Export Earnings and Import Substitution

Because of peak coffee prices in the mid-1950's, Colombia's export earnings rose to record levels. During this period of high and rising coffee prices, imports were not closely controlled, and financing by suppliers was available and used generously by importers. Even after coffee prices began to fall, the availability of credit sustained imports at a high rate for a few years. Some investment projects had to be delayed because internal savings were so low; in other cases, inflationary domestic credit was used to finance them (10, pp. 18-19).

After international coffee prices fell, an attempt was made to reduce the impact on income in the coffee sector, and to avoid further decreases in price. The Colombian Coffee Federation began to purchase surpluses. But this implied additional inflationary pressures, leading to a serious exchange crisis that ended in a devaluation by 1957. The potentially positive results of devaluation were not obtained by the economy. Wholesale prices of all commodities jumped 24 percent in 1957 and 17 percent in 1958. Again it became necessary to rely primarily on creation of money to purchase coffee surpluses (10, p. 44).

By the late 1950's, it became clear that Colombia needed to develop new export products. Most observers considered that the outstanding coffee prices of 1954 would not recur. In the initial stage, emphasis was placed on the development of an import-substitution policy rather than active export promotion (10, p. 4). For a few years, this policy brought good results to the economy because there was a wide range of import-substitution possibilities. However, these possibilities became unquestionably limited by the mid-1960's. The policy of import substitution increased import requirements of domestic manufacturing for intermediate goods and raw materials, and thus the pressures on the balance of payments were intensified.

General Development Plan

Prior to 1958, the Colombian Government had limited economic activity and programs. However, by 1958 the Government acknowledged the need for a general development plan. One was completed and published in 1962. Its basic objective was to obtain larger amounts of foreign exchange, directly by means of a substantial increase in exports and indirectly through a more dynamic import-substitution program. Cattle and cotton were pointed out as the most promising sources of foreign exchange, but no specific projects were developed for them. Pulp paper, steel, chemical fertilizers, edible oils, wool, and cocoa were indicated as the main commodities for import-substitution projects (10, pp. 102-104).

Major emphasis was placed on investment by the private sector, since domestic private savings were expected to rise from 11 percent of total GDP in 1959 to 18 percent by 1970 (10, p. 94). Investment in infrastructure would account for the great portion of the total, while investment in agriculture would be rather small (9, p. 125).

The importance of the industrial sector was stressed and its immediate past performance was considered a good index of prospects. To obtain the expected increase--8.4 percent--in the gross industrial product of the modern manufacturing sector, it was necessary to plan the cumulative growth of the agricultural gross product at 4.1 percent annually (10, p. 142). According to the General Development Plan, 45 percent of the expansion in crop production was to be obtained by higher yields. Exports and nonfood products were to expand more rapidly than food production. Most investment in agriculture would be directed toward benefiting already incorporated land.

The Plan had two stages, the first ending in 1964. Development then was to be reappraised to determine new--and, it was hoped, higher--specific targets for the remaining part of the plan period (through 1970). Initial targets were not reached. The agricultural planning was very general and was primarily limited to stating specific goals, giving no details on how they could be accomplished. 5/ Nonetheless, the need for an "integral agrarian reform" was stressed.

After the Plan was published in 1962, investment began to slow. Fiscal and monetary problems developed. Coffee prices continued weak, rising briefly in 1964. Despite the heavy restrictions on imported goods--relaxed when pressures were unbearable--large deficits developed from 1963 to 1965. Inflationary pressures led to successive crises in 1965 and 1966.

Failure to obtain new sources of foreign exchange caused maladjustment in the economy. Colombia was unprepared to begin massive exports, mainly because of high production costs in both the agricultural and the manufacturing sectors. Despite forced loans from the banking system, fiscal resources were insufficient and governmental investment had to be reduced. The economic climate deteriorated. Private investment dropped. It became increasingly difficult to secure international financing to keep the economy moving. Tight credit restrictions were

5/ For a complete analysis of the shortcomings of the General Development Plan, see (9, ch. 3).

imposed which hurt the manufacturing and tertiary sectors. Agriculture appeared to fare as well as other industries because it was favored by special institutions and by special legislation that increased allocations and reduced interest rates. However, the country's credit stringencies were quite general. Agriculture and manufacturing showed GDP growth rates lower than planned.

Effective demand for manufactures seemed too low to sustain an adequate rate of growth in the manufacturing sector. Throughout all of 1950-67, agriculture had grown about as fast as population, and had attained a substantial increase in productivity. Crop production had grown at a little above 3 percent annually, with substantial expansion of area in cultivation. Agrarian reform which began to operate by 1963 had not yet had a strong social or economic impact over the sector.

The proportion of exports represented by coffee declined (from a peak of over 80 percent in the early 1950's to around 60 percent in recent years), reflecting a decline in coffee receipts as well as appreciable increases in other exports (fig. 2).

A structural disequilibrium of the economy developed as noncoffee exports failed to provide enough foreign exchange to offset--at least--the diminishing coffee earnings. However, something has been done in recent years in the way of export promotion to counteract this failure. Now offered for minor exports is an export subsidy that partially offsets overvaluation of the peso. Also, a system of flexible exchange adjustment provides the mechanism for gradual change.

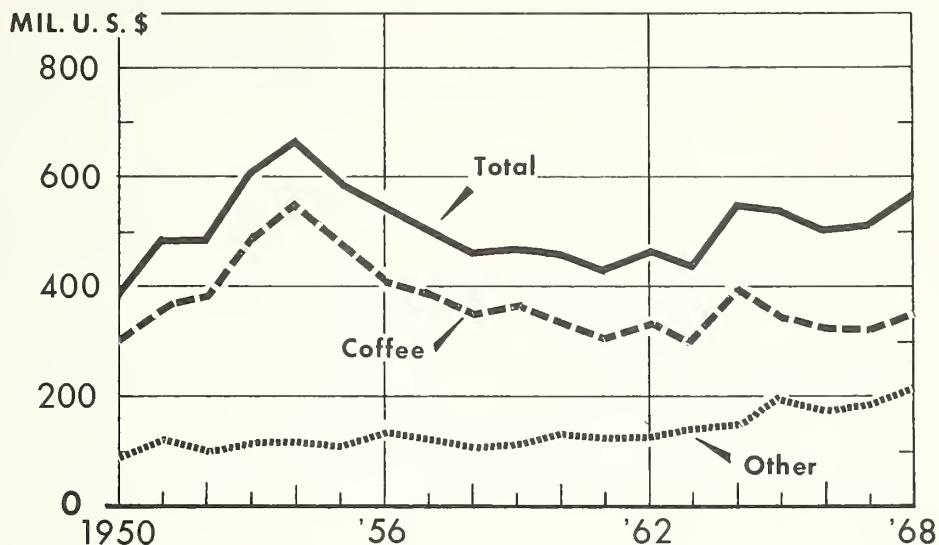
After years of uneven performance, exports of both coffee and other products expanded to reach target goals in 1968. Minor exports (that is, exports excluding coffee and petroleum) reached \$170 million, or about three times the value shipped during the early 1950's. However, this expansion did not close the gap left by the decline in coffee exports since the early 1950's. Nevertheless, expansion in minor exports occurred at a good rate during the 1960's, with both manufacturing and agriculture participating. An important element of national planning for the future is based upon a continuation of the strong growth in minor exports (figs. 2 and 3). During recent years, manufacturing exports have risen faster than minor agricultural exports, but most of this rise has been in processed farm products, including sugar and oilseed meal, which are not usually classified as manufactured products.

At the end of 1969 and the beginning of 1970, immediate prospects for increased earnings from major exports were improved by two developments. Coffee prices advanced sharply, following an assessment of large losses to the Brazilian crop and the appearance of a destructive rust. Oil began to flow through the new pipeline to the Pacific coast from the Putumayo area, holding out the prospect of a large increase in oil exports.

Agricultural Market for Industrial Products

An important relationship between agriculture and industry is industrial production of modern agricultural inputs and agriculture's demand for such inputs.

COLOMBIAN EXPORTS



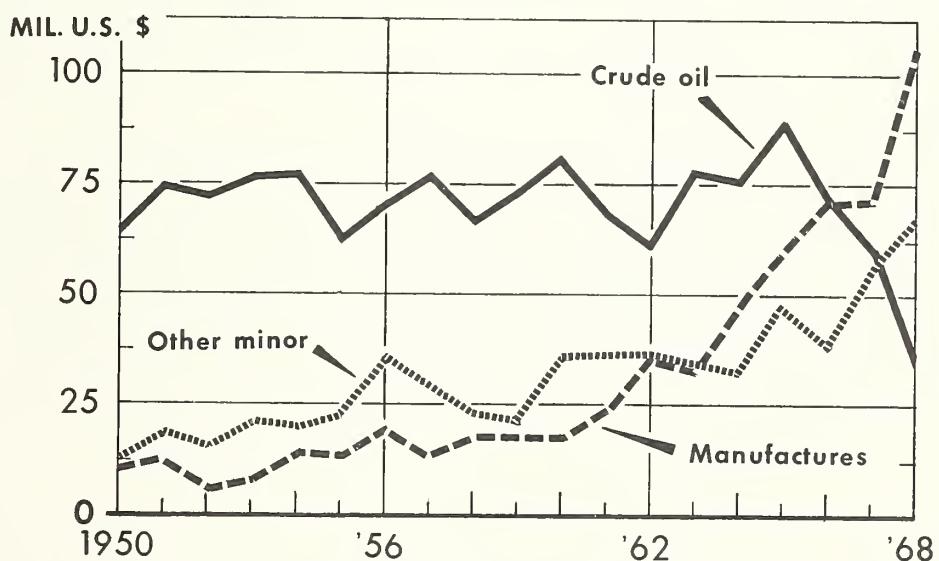
SOURCE: BANCO DE LA REPUBLICA, COLOMBIA.

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Figure 2

COLOMBIAN EXPORTS OTHER THAN COFFEE



SOURCE: BANCO DE LA REPUBLICA, COLOMBIA.

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Figure 3

The Central Bank (Banco de la República) estimates that the proportion of intermediate goods consumed in relation to the value of product added by agriculture rose slightly from 10 percent in 1950 to around 11 percent in 1965. For the crop sector alone, the proportion rose from 5 percent in 1950 to 7.5 percent in 1965. Data available for these estimates are quite fragmentary. If they may be assumed to be about the right order of magnitude, industry's supply of intermediate goods to agriculture is low but has grown somewhat faster than farm output.

The principal agricultural inputs Colombian industry produces include fertilizers, chemicals (mixed from imported raw materials), feed, and simple farm tools. The domestic fertilizer industry began operations in 1963; it is mixing almost all the fertilizer consumed in Colombia, and the nitrogen used is produced domestically. Total fertilizer consumption has been considerably higher in recent years than earlier, but the level of usage remains low, with very limited use for several nontraditional crops which are heavily fertilized in other countries. The marked acceleration in fertilizer use in many countries since the beginning of the 1960's has not occurred in Colombia. Production of fertilizer in Colombia in the past few years has not approached installed capacity, and fertilizer prices have risen faster than either farm product prices or the average of all prices.

A small part of the pesticides used in Colombia are mixed by domestic industry from imported materials. Production and distribution of improved seeds are of some importance. The less complicated agricultural implements are produced, and a few are exported. Chicken hatcheries and a small but expanding feed industry are being developed in the modern part of the poultry and egg industry. Although these agricultural supply industries are still small, they have expanded to provide increased inputs for agriculture and their output has partially replaced supplies formerly imported. (See ch. IV for fuller discussion of agricultural inputs.)

Capital and Credit

The flow of capital between agricultural and nonagricultural sectors is an important component of development in any country, and has received a good deal of attention. The most general conclusion is that agriculture in Colombia has about received its "share." Credit stringencies in agriculture have reflected general credit tightening. Lack of availability of credit does not appear to have been of crucial importance in limiting Colombia's commercial agricultural development (3, p. 5). However, the traditional subsector has been virtually cut off from (subsidized) institutional sources.

Migration of Farmworkers

One of the traditional functions of agriculture and rural areas is to provide excess manpower for urban employment. As Colombian agriculture becomes more productive, its farm manpower requirements grow more slowly. There are substantial labor surpluses in both urban and rural areas. Urban employment demands have been rising slowly, but a whole series of influences including a higher urban wage scale have attracted a large number of migrants from rural

areas to the cities. Nevertheless, the acceleration in population growth has been so great that the rural population and labor force growth rates were higher during the most recent intercensal period (1951-64) than in the preceding one (1938-51), and there is substantial underemployment in rural areas. Meanwhile, migration from the established agricultural areas (the areas west of the largely uninhabited eastern flatlands) continues unabated. The principal destinations are large cities, and the massive movement to them is highly visible and a troublesome problem that commands (or demands) attention.

One bright aspect here has been the considerable flow of migrants into new settlement areas, mainly in the piedmont strip between the mountains and the flat plains or jungle lands to the east. The land reform agency (INCORA) is extending help to some small landholders (minifundistas) and to a few thousand of the landless, to help them settle in the eastern frontier. It has built access roads; provided technical assistance, credit, and livestock; promoted development of unfamiliar crops adapted to the region; and organized cooperatives to purchase supplies and to market products. Settlers homestead tracts of around 50 hectares, and sometimes receive credit and technical advice to begin the conquest of the remote jungle strip with an ax, a hoe, a mattock, a machete, and a hand sickle.

CHAPTER II -- TOTAL FACTOR PRODUCTIVITY

A broad view of agricultural productivity may be obtained from an analysis of total factor productivity (6 and 22). To this end, total agricultural output for selected years was divided by combined annual inputs of labor, land, and capital for the same years. This provided a measure of changes in total factor productivity. However, such measures for Colombia must be regarded as approximations, because of data limitations. Furthermore, the data did not permit any breakdown of crop and livestock estimates nor separate treatment for coffee.

On the basis of data assembled for 1950, 1958, and 1967, calculations were made of total factor productivity for 1950-58 and 1958-67 (table 4). There was no appreciable difference in the rate of gain of productivity during the two periods. In both, total output rose 3.2 percent annually. About half the increase was due to an increase in total inputs; the rest was due to a rise in total factor productivity. Calculations for each period were made on the basis of prices at the beginning and at or near the end of each, but the resulting differences were slight. The rate of gain in productivity in the latter period is questionable, however, because of uncertainty in the capital stock estimate at the end of the period. Alternate estimates of capital stock in 1967 were used in the calculations. With one estimate, the same rate of increase in capital during the second period as in the first was assumed. The other was a higher estimate based on an interpolation of the National Department of Planning's projection for capital stock from the estimate made for 1964 and the projection for 1970 (26, p.19). Using the lower capital stock estimate, total factor productivity was a little higher in the second period than in the first. Use of the higher stock estimate resulted in a slightly lower productivity gain in the second period. No clear criteria exist for choosing between these alternative estimates. It seems plausible that the higher capital stock estimate (and the lower productivity gain) reflects the large inventory accumulation of coffee that took place between 1958 and 1967. For some purposes, one would want to include such capital investment in the calculation of agricultural productivity, but it may be convenient to exclude it for other purposes.

For the 17-year period 1950-67, total factor productivity in Colombian agriculture increased a little more than $1\frac{1}{2}$ percent a year. This is a substantial productivity gain. Although lower than the productivity increase in such rapidly developing countries as Mexico, Greece, and Taiwan, it is slightly above U.S. agriculture's 1.4-percent gain for the same period and substantially above the U.S average over the past several decades (15, p.17).

Partial Productivity Estimates

Available data permit a limited number of partial productivity calculations, although it is seldom appropriate to make direct comparisons between the early and the latter part of the 17-year period.

In the case of labor, the only information available is from the 1951 and the 1964 censuses of population. Adjusted data for these years were

Table 4.--Calculation of total factor productivity in Colombia, 1950-58 and 1958-67 in 1958 prices 1/

| Item | Inputs | | Prices | | Value of inputs | | |
|--|-----------|---------|---------|----------------|----------------------------------|--------------------------------------|------------|
| | 1950 | 1958 | 1967 | Original | Adjusted 2/ | 1950 | 1958 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | 1,000 ha. | | | Pesos/ha. | | | Mil. pesos |
| Land: | | | | | | | |
| Cultivated..... | 2,651 | 3,198 | 3,630 | 458.56 | 487.00 | 1,291.0 | 1,557.4 |
| Pasture..... | 13,463 | 14,550 | 14,770 | 66.30 | 70.40 | 947.8 | 1,024.3 |
| | | | | Pesos/man-year | | | |
| Employment..... | 1,781 | 1,956 | 2,169 | 1,118.00 | 1,187.00 | 2,114.0 | 2,321.8 |
| | | | | Mil. pesos | Pesos/ pesos of capital stock | | |
| Capital stock..... | 13,550 | 14,676 | 16,000 | 0.10 | 0.10618 | 1,438.7 | 1,558.3 |
| | | | | 1,000 pesos | Pesos | | |
| Purchased inputs.. | 539,000 | 720,000 | 977,000 | 1.00 | 1.0618 | 572.3 | 764.5 |
| | | | | | | | |
| Increase in productivity | | | | | | Input | 6,363.8 |
| 1950-58: $\frac{1.000}{0.8796} - 1.00 = 13.68$ percent or 1.6 percent per year | | | | | | Output | 7,226.3 |
| | | | | | | | 8,118.5 |
| 1958-67: | | | | | | $\frac{\text{Output}}{\text{Input}}$ | 0.8796 |
| | | | | | | Input | 1.000 |
| | | | | | | | 1.16781 |

1/ This calculation based on an increased in capital investment of 9 percent between 1958 and 1966, the same rate as in the preceding period.

2/ A price increase of about 6 percent was made so that inputs would equal output in 1958.

Source: See text, p. 17.

extrapolated for 1950 and 1967, and the estimate for 1958 was interpolated. During the whole period, the labor force in agriculture is estimated to have increased a little more than 1 percent annually, compared with a 3-percent annual increase in total agricultural output. Thus, output per person rose at an average annual rate of 2 percent.

Intermediate products consumed -- such as fertilizer, insecticides, and seeds -- rose faster than output -- 3.8 percent annually during 1950-58 and 3.3 percent annually during 1958-67. Although this difference between the first and the second parts of the period seems reasonable, these estimates are based upon summary data. A principal characteristic of such inputs is that they represented a small fraction of output -- in 1958, a little over 10 percent.

Cultivated land increased 1.8 percent annually during 1950-67, with pasture area rising only 0.5 percent annually. The weighted average value of all land in 1958 prices rose 1.3 percent annually, or two-fifths as rapidly as total output of all crops and livestock and livestock products. Between the first part and the second part of the 17-year period there was no appreciable difference in the average rise in output in relation to land. Output of major crops and the area devoted to these crops offer a more specific comparison. Since average output per hectare varies considerably from year to year, the following comparison is based on 3-year averages (1948-50 and 1966-68) at the beginning and end of the period. Output of major crops increased 3.15 percent a year, with area rising 1.80 percent and output per hectare rising 1.35 percent annually.

Although area expanded somewhat faster than output per hectare, the latter represented a substantial gain during the period. Aside from year-to-year variations characteristic of crop series, output per hectare rose very unevenly through the years and among the principal crops. For the first several years, per hectare production was essentially stable, showing only year-to-year fluctuations. It was rather low in 1954-55, but then advanced in the next years to a plateau beginning in 1959 that was well above any earlier year's level. Between 1959 and 1966, yields showed no definite trend. They rose substantially in 1967, continuing high in 1968 and -- according to preliminary reports -- 1969.

The largest yield increases were in the crop groups that by the end of the period were being produced under relatively modern technology. These include cotton, rice, and cane for centrifugal sugar (group 5) and barley, soybeans, grain sorghum, and sesame seed (5A). Both groups had large expansion in area during the period. Although plantation-type tree crops of bananas and cocoa (group 4) were limited in area, they were produced under improved technology. Each of these three groups increased output per hectare by more than half; group 5 yields rose by two-thirds. Coffee yields varied greatly, with some highs occurring near the beginning of the period and during the last decade, but with lower yields for several years in the mid-1950's. The crops produced under mixed technology (group 3) had yield increases of one-third during the period, with good gains for wheat and tobacco and little change for corn and potatoes. Plantains, cane for panela, yuca, and beans (group 2) showed no appreciable trend in yields.

Some Details of the Productivity Calculations

The calculations of productivity for 1950-58 and 1958-67 used prices for the initial year of each period in one calculation and for a year at or near the end of each period in another (table 5). The two sets of estimates were only slightly different; the average of the two was used. For the sake of simplicity, the steps explained will be illustrated in 1958 prices when an illustration appears helpful.

For input-output calculations, inputs were broken into five groups: (1) cultivated land, (2) pasture, (3) labor, (4) capital, and (5) current expenses (table 6).

The value for cultivated land inputs was estimated to be one-third of production in the base year. The estimate of one-third is based principally upon rent paid as reported by the Latin American Center for Agricultural Marketing (ILMA) (23, pp. 17 and 17a). This direct method avoids valuation of the land and making a decision as to the rate of return to land.

The estimate for pasture is more indirect and less firmly based. The hectares of pasture were taken or interpolated from estimates of the National Statistics Department of Colombia (DANE). The value of the pasture input per hectare in the base year was assumed to be one-half the value of beef cattle, horses, mules, and asses "produced" and one-third the value of dairy, sheep, and goat production (5, app.).

The labor input was based on total agricultural employment interpolated from the 1951 and 1964 censuses of population adjusted by Alvaro López, Universidad de los Andes. The wage rates paid for hired labor in the base years were used for all farm-employed persons. The estimates from DANE of daily wage rates in warm climate zones were multiplied by an estimated 250 working days per year, resulting in an average labor input of 1-3/4 man-years per farm.

Capital stock was taken from estimates made by the National Department of Planning (26) as explained above, page 14. The rate of return was assumed to be 10 percent in constant pesos.

Current expenses -- for such items as fertilizer and seeds -- are from the National Income Accounts of the Banco de la República.

Input values were then calculated and summed for the base year -- for example, 1958. If they did not equal output for that year, the price of the value per unit of inputs was adjusted by a uniform percentage to make input equal output in the base year. Then these same values per unit or prices for the inputs were used to calculate total input in the non-base year.

The change in output compared with the change in input was the basis for the calculated gain in productivity.

Table 5.--Rate of growth in total factor productivity, Colombia, 1950-58 and 1958-67

| Increase in capital investment (1958-67) | 1950-58 | | | | 1958-67 | | | |
|--|------------|------|-----------------------|------------|------------|------|-----------------------|-----|
| | Prices of: | | Annual average growth | Prices of: | Prices of: | | Annual average growth | |
| | 1950 | 1958 | | | Average | 1958 | | |
| | Percent | | | | Percent | | | |
| 9 | : 13.8 | 13.7 | 13.8 | 1.6 | : 16.8 | 17.2 | 17.0 | 1.8 |
| 23 | : --- | --- | --- | --- | : 13.7 | 14.5 | 14.1 | 1.5 |
| 37 | : --- | --- | --- | --- | : 10.7 | 11.8 | 11.2 | 1.2 |

Table 6.--Prices used in total factor productivity calculations for Colombia, 1950, 1958, and 1966

| Item | 1950 | 1958 | 1966 1/ |
|-------------------------|--------|----------|----------|
| <u>Pesos/ha.</u> | | | |
| Land, cultivated..... | 208.88 | 458.56 | 1,081.54 |
| <u>Pesos/man-year</u> | | | |
| Pasture..... | 27.49 | 66.30 | 192.38 |
| Employment..... | 650.00 | 1,118.00 | 3,565.00 |
| <u>Pesos 2/</u> | | | |
| Capital investment..... | 0.54 | 1.00 | 2.38 |
| Purchased inputs..... | 0.54 | 1.00 | 2.38 |

1/ 1966 prices were used for 1967 computation.

2/ 1958 = 1.00 peso.

Crop Yields by Size of Farm

How do yields vary by size of farm? The National Statistics Department of Colombia has made available tabulations of yields by size of farm for major crops for the first half of 1966. The data are based upon a sample census survey, and thus are subject to sampling error as well as other types of errors.

The data for 17 major crops are shown in table 7, at the end of this chapter. They will be discussed in groups that had similar characteristics or relationships. The principal tabulation (stub) is by size of farm, but the number of farms, area harvested, and production are also shown, so that the average area of each crop harvested per farm can be calculated for each size group.

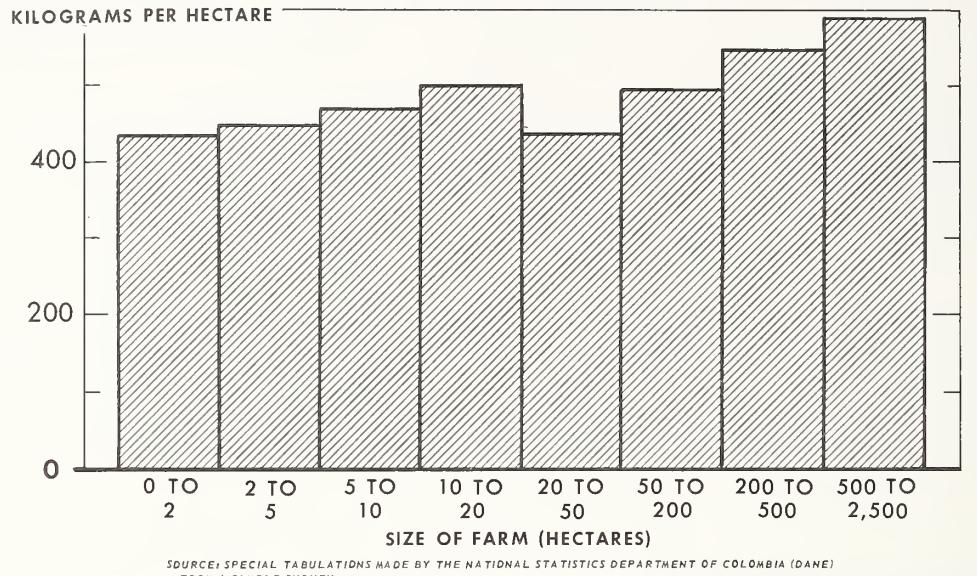
For several crops, there was no significant relationship between size of farm and yield. Two relatively minor tree crops, bananas and cocoa (group 4), fall into this group. So do plantains, beans, and yuca (group 2), and green peas; it seems significant that these four crops all have very small area per farm even on large farms, and it is postulated that they are all grown under similar technology (traditional) regardless of the size of farm.

Coffee yields by size of farm represented some variations from the crops discussed above. Yields averaged higher on larger farms than on smaller farms, but with considerable variation (fig. 4). They rose appreciably from the smallest size farms up to those with 10 to 20 hectares, and then rose again for large farms above 50 hectares. It should be mentioned that the size of the coffee planting did not rise proportionally with the size of farm. Thus, coffee area averaged 4-1/2 hectares on 20- to 30-hectare farms, whereas farms of 30-40, 40-50, and 50-100 hectares each averaged about 5 hectares in coffee. Although advanced, high-yield technology does exist for coffee production and is of conspicuous importance, it does not appear to be closely related to the size of farm.

Among crops in group 3, corn showed the least increase in yield as farm size increased (fig. 5). There was no appreciable change in average yield from the smallest farms up through the 20- to 50-hectare size. Yields were then somewhat higher for larger farms, averaging 1,100 to 1,200 kilograms per hectares (17.5 to 19 bushels per acre), compared with 800 kilograms for farms of 50 hectares or less. This difference is appreciable but not striking. Again, as in the case of coffee, the large farms did not have large areas planted to corn. The 500- to 1,000-hectare farms averaged only 10 hectares of corn. Tobacco yields showed no relationship to size of farm through the range that included more than 90 percent of the area. They were appreciably higher, however, for the small group of farms larger than 500 hectares. The other crops in group 3 -- potatoes and wheat -- as well as barley in group 5A all showed a considerable rise in yield with increase in size of farm. The average area per farm showed a considerable increase with farm size. This suggests that the increased yield on the larger area on the larger farms was associated with better technology.

Colombia's Major Crops

**GROUP 1.--COFFEE: AVERAGE YIELD BY SIZE OF FARM,
FIRST HALF OF 1966**



SOURCE: SPECIAL TABULATIONS MADE BY THE NATIONAL STATISTICS DEPARTMENT OF COLOMBIA (DANE)
FROM A SAMPLE SURVEY.

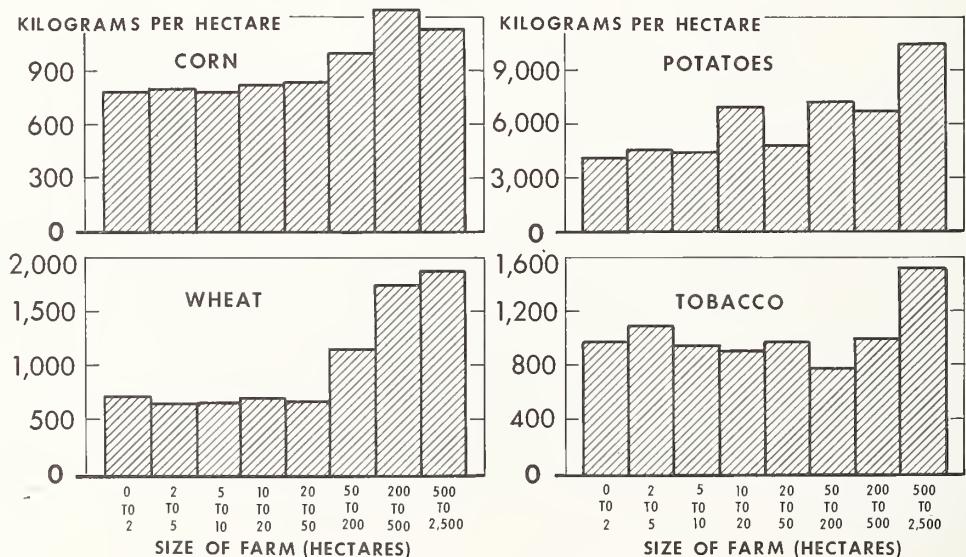
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Figure 4

Colombia's Major Crops

**GROUP 3.--CORN, POTATOES, WHEAT, AND TOBACCO:
AVERAGE YIELD BY SIZE OF FARM, FIRST HALF OF 1966**



SOURCE: SPECIAL TABULATIONS MADE BY THE NATIONAL STATISTICS DEPARTMENT OF COLOMBIA (DANE)
FROM A SAMPLE SURVEY.

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Figure 5

Commercial Crop Yields

Cotton, rice, and sugarcane (group 5) had some similarity in their yield pattern by size of farm (fig. 6). The yields were much higher on the very large farms than on small farms, but organizational structures of farms growing the three crops vary greatly. Rice production is important throughout the full range of farm sizes. Sugarcane has a marked dualism, with many very small growers and considerable area on very large farms. Cotton production is a specialized enterprise on large farms, and is rarely found on small farms.

Rice yields showed little variation from the smallest farms up through the 20- to 50-hectare size. There was a limited range in the average area harvested per farm, from nearly 1 hectare for very small farms to less than 3 hectares until the 20- to 50-hectare size farm was reached. Yields rose irregularly through the 200- to 500-hectare size farms, and the average area harvested varied from 5 to 10 hectares per farm.

The principal increase in rice yields was for farms larger than 1,000 hectares; on these farms, area of rice harvested averaged about 40 hectares per farm. It seems probable that the large farms have a higher proportion of artificial irrigation than the intermediate and small farms, which often rely upon natural valley irrigation or abundant rainfall.

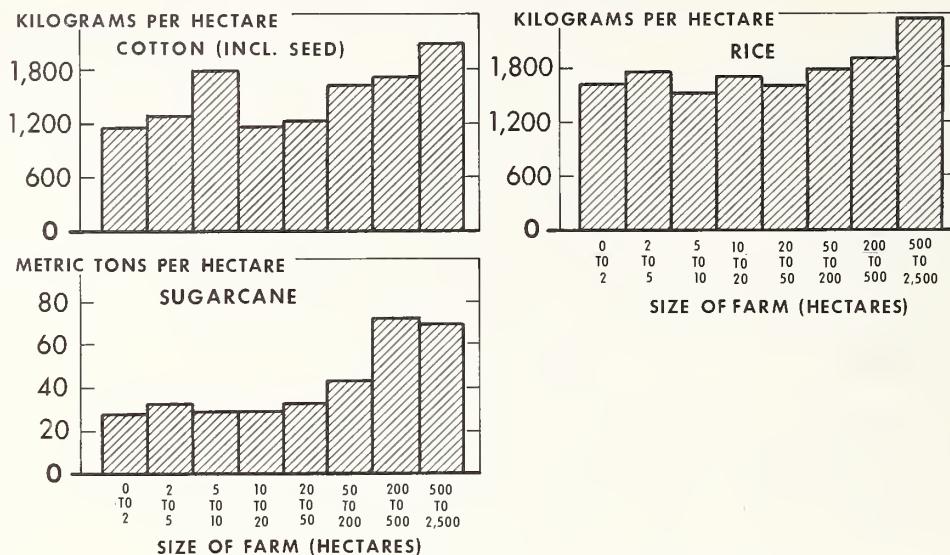
Sugarcane production includes both panela and centrifugal sugar, and it is not possible to separate the two very different groups of producers. Yields are stable and low -- 30 tons per hectare -- for all farm groups up through 50 hectares in size, with area harvested per farm quite small, reaching 2 hectares for the 40- to 50-hectare farms. After a small transitional rise in yields to around 40 tons for intermediate-size farms (50 to 200 hectares), yields rise to 80 to 100 tons on large farms. The interpretation is that traditional technology characterizes the small farmers producing panela, and that improved technology and far higher yields are the norm for large farmers producing cane for centrifugal sugar in the fertile Cauca valley.

There are few cotton farms smaller than 50 hectares and their yields are low -- around 1,000-1,200 kilograms per hectares or 900-1,100 pounds of seed cotton per acre. (The apparent exception of unusually high yields for farms from 5 to 10 hectares in size (fig. 6) seems improbable, and no interpretation will be made.) Large farmers grow most of the cotton; their yields are about twice those of small farmers. Very large farms (over 500 hectares) obtain moderately higher yields than intermediate to large farms (50 to 500 hectares). These estimates refer to the interior region, principally Tolima, that is cultivated in the first half of the year. They exclude the larger Valledupar and coastal areas that produce cotton only in the second half.

The final crops are two from group 5A, sesame and grain sorghum. For sesame, there is no clear-cut relationship between yield and size of farm, but yields are substantially higher on farms above 200 hectares (fig. 7). Grain sorghum yields show a strong direct relationship to size of farm, with intermediate and large farms obtaining yields about twice as high as farms with less than 10 hectares. The latter group of small farms have harvested areas of grain sorghum averaging only about 1 hectare, with yields of 1 ton

Colombia's Major Crops

GROUP 5.--COTTON, RICE, AND SUGARCANE: AVERAGE YIELD BY SIZE OF FARM, FIRST HALF OF 1966



SOURCE: SPECIAL TABULATIONS MADE BY THE NATIONAL STATISTICS DEPARTMENT OF COLOMBIA (DANE) FROM A SAMPLE SURVEY.

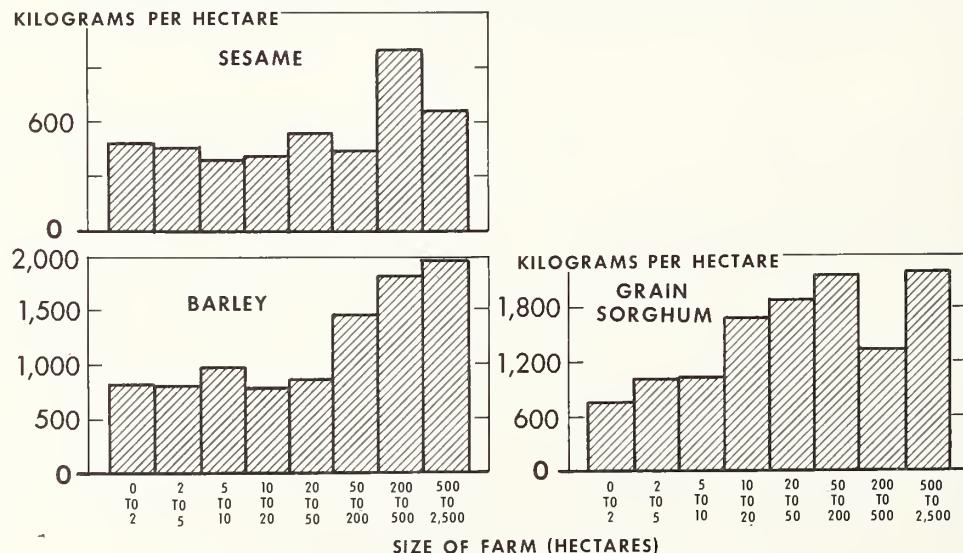
U.S. DEPARTMENT OF AGRICULTURE

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Figure 6

Colombia's Major Crops

GROUP 5A.--SESAME, BARLEY, AND GRAIN SORGHUM: AVERAGE YIELD BY SIZE OF FARM, FIRST HALF OF 1966



SOURCE: SPECIAL TABULATIONS MADE BY THE NATIONAL STATISTICS DEPARTMENT OF COLOMBIA (DANE) FROM A SAMPLE SURVEY. DATA NOT AVAILABLE FOR SOYBEANS, THE FOURTH GROUP 5A CROP.

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Figure 7

per hectare. Such yields are in the same low range as the corn yields on most farms using traditional practices. In contrast, the yields of 2 tons of sorghum on the larger farms represent good performance.

In summary, not quite half of the crops showed little relationship between yield and size of farm. Some of these, such as yuca and plantains, are grown by similar traditional methods on a small scale regardless of the size of the farm. Improved methods of production for these crops have not been developed. Two important crops, coffee and corn, both show relatively small increases in yield for the larger farms, although improved methods of production are used by a considerable number of farmers. In contrast, tobacco had higher yields on only a few large farms. Yields were directly related to farm size for a long list of crops produced for sale -- potatoes, wheat, barley, cotton, rice, sugarcane, and grain sorghum. For these crops, the increase in farm size was accompanied by an appreciable increase in acreage cultivated per farm, and by improved farming practices. The possibility that the larger farmers had a higher proportion of productive land has not been invoked because of the absence of data. Informal observation suggests that such a relationship was significant for sugarcane (where big plantations are in the fertile Cauca valley and most small growers are on hillsides), and possibly significant for potatoes, wheat, barley, and rice.

Table 7.--Crop yields by size of farm and crop group, Colombia, first half of 1966

| Size of farm (hectares) | | Group 1-- Coffee | | | Group 2 Yucca | | | Plantains | | | |
|----------------------------|----------------------|---------------------|-------|----------------------|------------------|-------|----------------------|-----------|-------|----------------------|---------|
| Farms | Area : harvested: | Yield | Farms | Area : harvested: | Yield | Farms | Area : harvested: | Yield | Farms | Area : harvested: | Yield |
| No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. |
| 0 -2..... | 95,766 | 37,145 | 433 | 28,080 | 7,714 | 7,371 | 20,761 | 5,894 | 255 | 81,185 | 18,325 |
| 2 -5..... | 115,567 | 122,241 | 447 | 58,932 | 23,750 | 6,618 | 26,821 | 14,322 | 284 | 105,313 | 45,483 |
| 5 -10..... | 83,915 | 165,826 | 468 | 44,113 | 23,830 | 6,114 | 17,643 | 12,274 | 271 | 78,576 | 55,734 |
| 10 -20..... | 53,562 | 171,175 | 502 | 31,774 | 20,206 | 5,955 | 12,667 | 10,420 | 288 | 54,446 | 50,379 |
| 20 -50..... | 36,906 | 170,053 | 435 | 34,950 | 27,312 | 6,693 | 11,402 | 11,257 | 291 | 48,201 | 59,358 |
| 50 -200.... | 21,137 | 138,659 | 497 | 28,104 | 31,662 | 9,056 | 6,903 | 16,013 | 297 | 39,275 | 60,161 |
| 200-500.... | 3,017 | 25,274 | 549 | 6,669 | 11,947 | 9,802 | 1,285 | 6,406 | 360 | 8,847 | 18,736 |
| 500-2,500... | 1,375 | 23,751 | 591 | 3,409 | 12,260 | 9,953 | 550 | 2,738 | 469 | 4,237 | 12,446 |
| | | | | | | | | | | | 771 |
| Group 3 | | | | | | | | | | | |
| Corn | Area : harvested: | Yield | Farms | Area : harvested: | Yield | Farms | Area : harvested: | Yield | Farms | Area : harvested: | Tobacco |
| No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. |
| 0 -2..... | 131,346 | 43,934 | 786 | 40,020 | 10,387 | 4,090 | 27,541 | 9,709 | 704 | 4,861 | 2,798 |
| 2 -5..... | 130,340 | 96,966 | 791 | 39,363 | 21,090 | 4,578 | 29,581 | 22,378 | 620 | 13,800 | 12,143 |
| 5 -10..... | 70,351 | 74,321 | 774 | 16,682 | 13,035 | 4,459 | 12,067 | 17,298 | 639 | 6,060 | 8,759 |
| 10 -20..... | 46,654 | 71,126 | 819 | 9,482 | 12,154 | 6,904 | 6,844 | 14,239 | 694 | 2,701 | 4,853 |
| 20 -50..... | 42,714 | 75,122 | 830 | 5,159 | 6,321 | 4,780 | 2,806 | 8,149 | 642 | 1,323 | 2,379 |
| 50 -200.... | 34,809 | 105,164 | 1,013 | 3,182 | 8,866 | 7,174 | 1,150 | 17,171 | 1,142 | 574 | 3,288 |
| 200-500.... | 8,187 | 56,160 | 1,231 | 799 | 4,320 | 6,682 | 306 | 4,586 | 1,742 | 385 | 1,580 |
| 500-2,500... | 3,958 | 49,715 | 420 | 2,634 | 11,421 | 239 | 1,809 | 1,858 | 146 | 3,749 | 1,570 |

Table 7.--Crop yields by size of farm and crop group, Colombia, first half of 1966--con.

| Size of farm (hectares) | | Group 4 | | | | Group 5 | | | |
|----------------------------|--------------------|-----------|--------|--------------------|---------|---------------|--------------------|---------|--------------------|
| | | Bananas | | Cocoa | | Cotton | | Rice | |
| Farms | Area harvested: | Yield | Farms | Area harvested: | Yield | Farms | Area harvested: | Farms | Area harvested: |
| No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | Ha. |
| 0 -2..... | 15,064 | 2,806 | 735 | 7,081 | 1,548 | 356 | 180 | 1,167 | 4,920 |
| 2 -5..... | 26,164 | 8,330 | 693 | 7,743 | 3,324 | 271 | 660 | 863 | 11,585 |
| 5 -10..... | 25,206 | 12,579 | 724 | 7,929 | 4,479 | 257 | 300 | 1,128 | 1,253 |
| 10 -20..... | 15,271 | 11,753 | 750 | 5,834 | 5,528 | 250 | 300 | 1,956 | 1,793 |
| | | | | | | | | 1,158 | 1,158 |
| 20 -50..... | 14,303 | 12,394 | 725 | 6,438 | 7,901 | 240 | 260 | 2,900 | 1,201 |
| 50 -200.... | 9,721 | 18,710 | 726 | 4,241 | 6,487 | 226 | 595 | 21,397 | 1,619 |
| 200-500.... | 2,016 | 10,517 | 668 | 974 | 1,546 | 231 | 267 | 10,333 | 1,708 |
| 500-2,500.... | 1,310 | 3,461 | 852 | 490 | 1,624 | 342 | 298 | 9,011 | 2,090 |
| | | | | | | | | 1,926 | 1,926 |
| | | | | | | | | | 14,371 |
| | | | | | | | | | 1,693 |
| | | Group 5 | | | | Group 5A | | | |
| | | Sugarcane | | | | Barley | | | |
| Farms | Area harvested: | Yield | Farms | Area harvested: | Yield | Farms | Area harvested: | Farms | Area harvested: |
| No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | Ha. |
| 0 -2..... | 51,423 | 11,657 | 26,668 | 3,300 | 1,648 | 474 | 12,660 | 3,855 | 806 |
| 2 -5..... | 79,504 | 41,717 | 31,364 | 6,060 | 6,813 | 454 | 11,520 | 7,312 | 794 |
| 5 -10..... | 60,814 | 51,034 | 28,422 | 2,940 | 6,180 | 378 | 5,402 | 5,799 | 987 |
| 10 -20..... | 37,499 | 46,035 | 28,595 | 1,441 | 3,125 | 413 | 2,101 | 2,752 | 778 |
| | | | | | | | | | 720 |
| 20 -50..... | 29,704 | 51,605 | 32,369 | 1,277 | 3,308 | 530 | 863 | 1,006 | 837 |
| 50 -200.... | 17,206 | 53,824 | 42,656 | 1,410 | 7,239 | 432 | 514 | 5,789 | 1,460 |
| 200-500.... | 2,987 | 26,638 | 72,424 | 629 | 4,224 | 1,005 | 227 | 5,702 | 1,790 |
| 500-2,500.... | 1,987 | 58,398 | 68,771 | 473 | 5,068 | 653 | 252 | 3,421 | 1,996 |
| | | | | | | | | | 75 |
| | | | | | | | | | 2,893 |
| | | | | | | | | | 2,194 |
| | | | | | | | | | 1,674 |
| | | Sesame | | | | Group 5B | | | |
| | | Sorghum | | | | Grain sorghum | | | |
| Farms | Area harvested: | Yield | Farms | Area harvested: | Yield | Farms | Area harvested: | Farms | Area harvested: |
| No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | No. | Ha. | Kg./ha. | Ha. |
| 0 -2..... | 51,423 | 11,657 | 30 | 3,300 | 1,648 | 474 | 12,660 | 3,855 | 806 |
| 2 -5..... | 79,504 | 41,717 | 31 | 3,64 | 6,060 | 6,813 | 11,520 | 7,312 | 794 |
| 5 -10..... | 60,814 | 51,034 | 28 | 422 | 2,940 | 6,180 | 5,402 | 5,799 | 987 |
| 10 -20..... | 37,499 | 46,035 | 28 | 595 | 1,441 | 3,125 | 2,101 | 2,752 | 778 |
| | | | | | | | | | 720 |
| 20 -50..... | 29,704 | 51,605 | 32 | 369 | 1,277 | 3,308 | 530 | 863 | 1,006 |
| 50 -200.... | 17,206 | 53,824 | 42 | 656 | 1,410 | 7,239 | 432 | 514 | 5,789 |
| 200-500.... | 2,987 | 26,638 | 72 | 424 | 629 | 4,224 | 1,005 | 227 | 5,702 |
| 500-2,500.... | 1,987 | 58,398 | 68 | 771 | 473 | 5,068 | 653 | 252 | 3,421 |
| | | | | | | | | | 1,996 |
| | | | | | | | | | 75 |
| | | | | | | | | | 2,893 |
| | | | | | | | | | 2,194 |

Continued--

Table 7.--Crop yields by size of farm and crop groups, Colombia, first half of 1966--Con.

| Size of farm (hectares) | Green peas | | |
|----------------------------|------------|----------------|---------|
| | Farms | Area harvested | Yield |
| | No. | Ha. | Kg./ha. |
| 0 -2..... | 6,960 | 1,625 | 322 |
| 2 -5..... | 9,060 | 4,308 | 350 |
| 5 -10..... | 5,101 | 2,497 | 268 |
| 10 -20..... | 4,262 | 5,157 | 347 |
| | | | |
| 20 -50..... | 2,295 | 3,900 | 344 |
| 50 -200..... | 846 | 1,989 | 434 |
| 200-500..... | 430 | 1,626 | 387 |
| 500-2,500..... | 49 | 272 | 965 |
| | | | |

Source: Special tabulations made by the National Statistics Department of Colombia (DANE) from a sample survey.

CHAPTER III--AGRICULTURAL PRICES AND THE GENERAL PRICE LEVEL

Colombia's general price level has advanced about 10 percent annually since 1950. Although below the hyperinflation prevailing in a number of Latin American countries, the price advance has represented substantial inflation in relation to world prices and has necessitated periodic devaluations of the currency.

The devaluations were not simple, neutral events that occurred promptly when the currency became overvalued as a result of internal price advances. For complex reasons, adjustment to inflation never became "institutionalized" and more or less automatic, as in the case of some of the countries undergoing hyperinflation.

Although the price rise since 1950 has been quite general, it has not been steady. Prices did not advance in 1952, when there was a slight decline in wholesale prices. The advance resumed in 1953, and accelerated in 1954 as agricultural prices moved upward rather sharply. Prices then leveled off in 1955, as agricultural prices declined. After 1955, prices began to move upward in an almost uninterrupted advance (figs. 8 and 9). Advances were large in 1957, 1963-64, and 1965-66. But the slowdown that began in 1967 continued through 1969. (For all the price charts--figs. 8-24--the data are given in tables 8-24 at the end of this chapter.)

Three series may be used to show general price movements in Colombia. One is an index of wholesale prices, a second is of retail prices paid by employees, and a third is a more comprehensive series, the implicit price deflators for gross national product. The implicit price deflators reflect the price changes of all goods and services produced.

As can be seen in figure 10, the movement of each of the series is quite similar, giving the same general picture, regardless of which series is used. Throughout this chapter, the broader series, based on gross national product, has been used for deflation purposes.

Against this general background of price changes, we wish to examine how agricultural prices performed during 1950-67. This examination will include the movement of prices of the various products and groups within agriculture as well as the relation between agricultural and nonagricultural price movements.

The questions for which answers are sought are: Have agricultural prices been too high in relation to nonagricultural prices, or have they risen faster, thus tending to put a brake on economic development? Have prices been too low to be an effective incentive for farmers, thus retarding expansion? How appropriately have the relative prices of the various groups of agricultural products been adjusted? For products or groups whose prices have risen more than others, has an expansion in acreage and production followed price increases or have such price advances been principally the result of a reduction in production? More generally, has there been a close correlation between relative price changes and relative changes in acreage and production of crops? Finally, have prices of nontraditional inputs such as fertilizer been high or low in

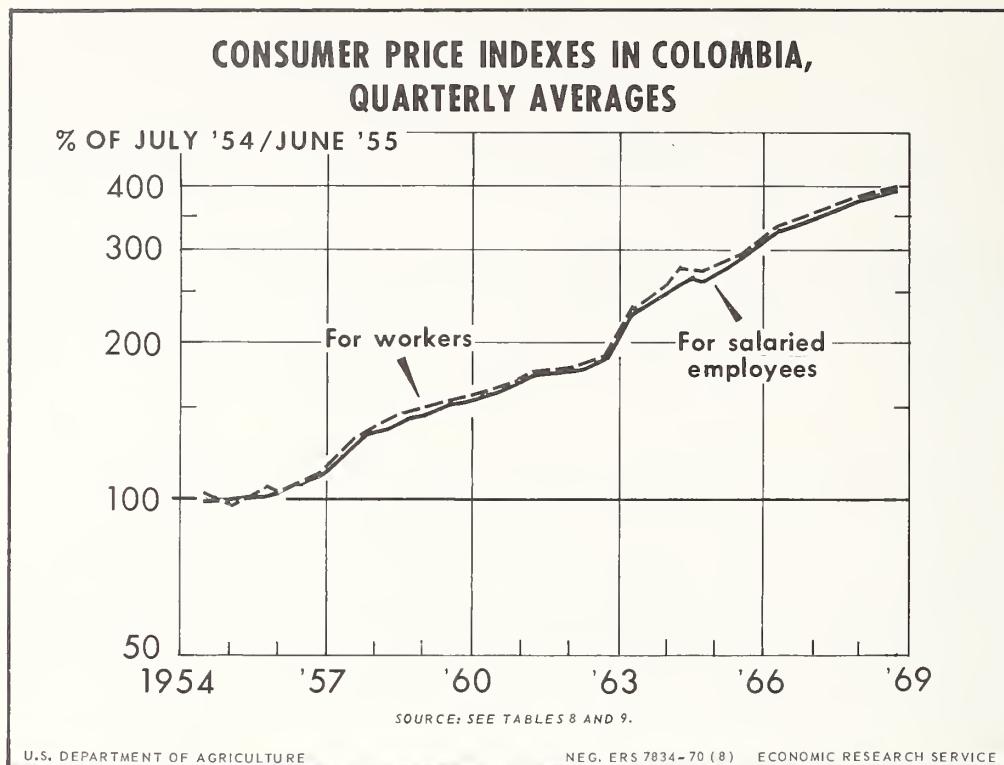


Figure 8

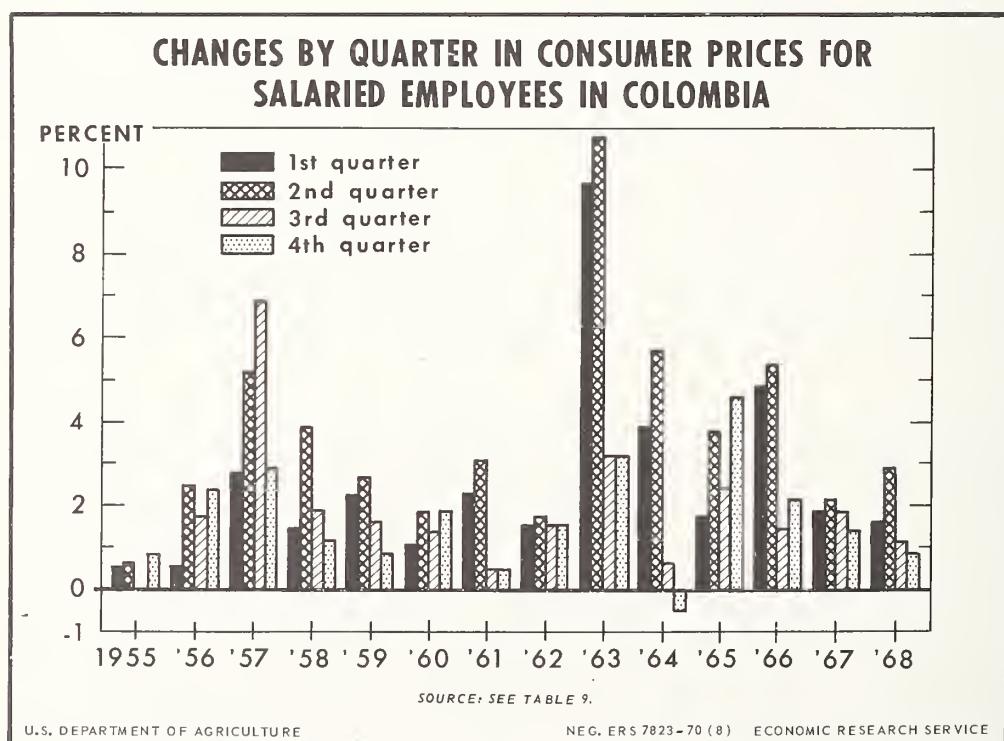


Figure 9

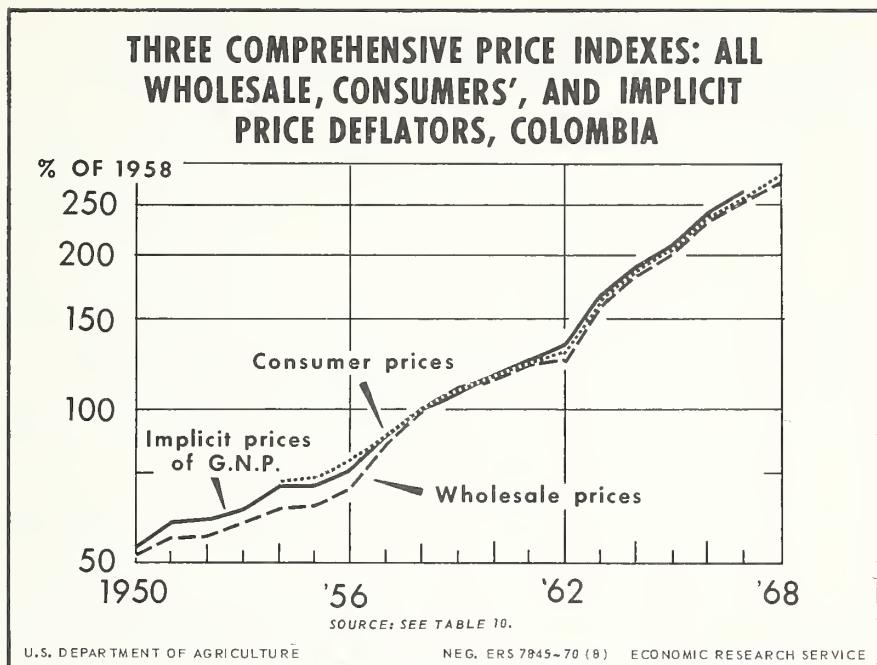


Figure 10

relation to farm product prices and world market prices, and how have these price relationships changed during the past several years?

Since current prices rose substantially throughout the period under review, they were adjusted through deflation by a general price series. Some of the production data are given on a per capita basis; this is a convenient method for comparison, since total agricultural production per capita has been relatively stable in Colombia.

Farm and Nonfarm Prices

During 1950-67 as a whole, agricultural prices rose at about the same rate as nonagricultural prices (fig. 11). These two price series are based upon the implicit price series derived from the national product accounts prepared by the country's central bank (Banco de la República). Agricultural prices were highest in relation to nonagricultural prices in 1954, culminating a long relative advance during World War II and several postwar years. This was a period when farm prices throughout the world rose more rapidly than nonfarm prices. In the United States, the rise in farm prices relative to nonfarm prices was considerably greater than in Colombia.

For several years after 1954, agricultural prices in Colombia rose somewhat less rapidly than nonagricultural prices, so that the ratio of farm to nonfarm prices drifted irregularly downward until 1962, when the ratio was about the same as in 1950. A severe drought during 1963 was followed by a

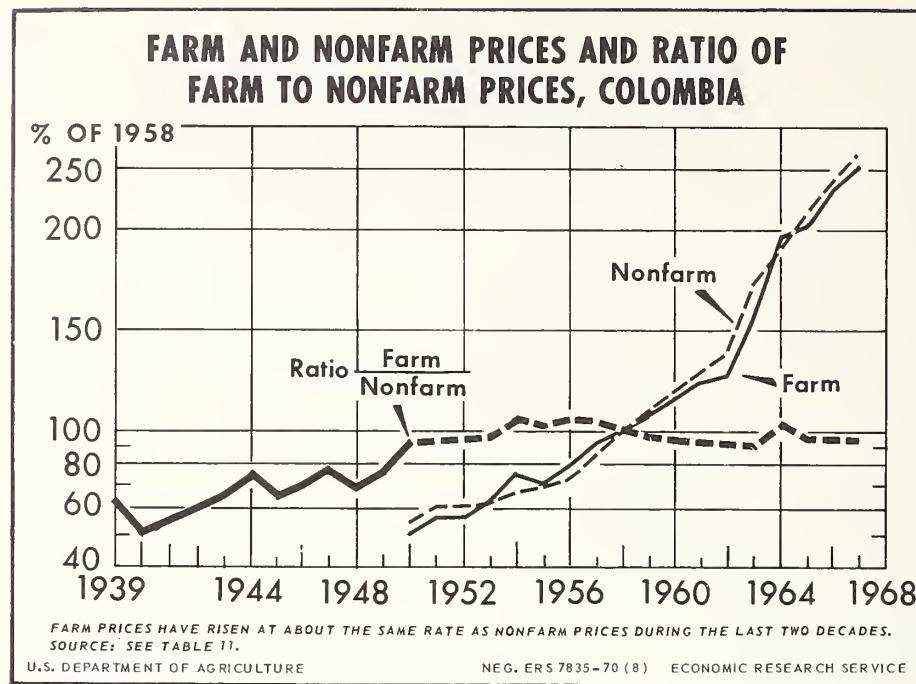


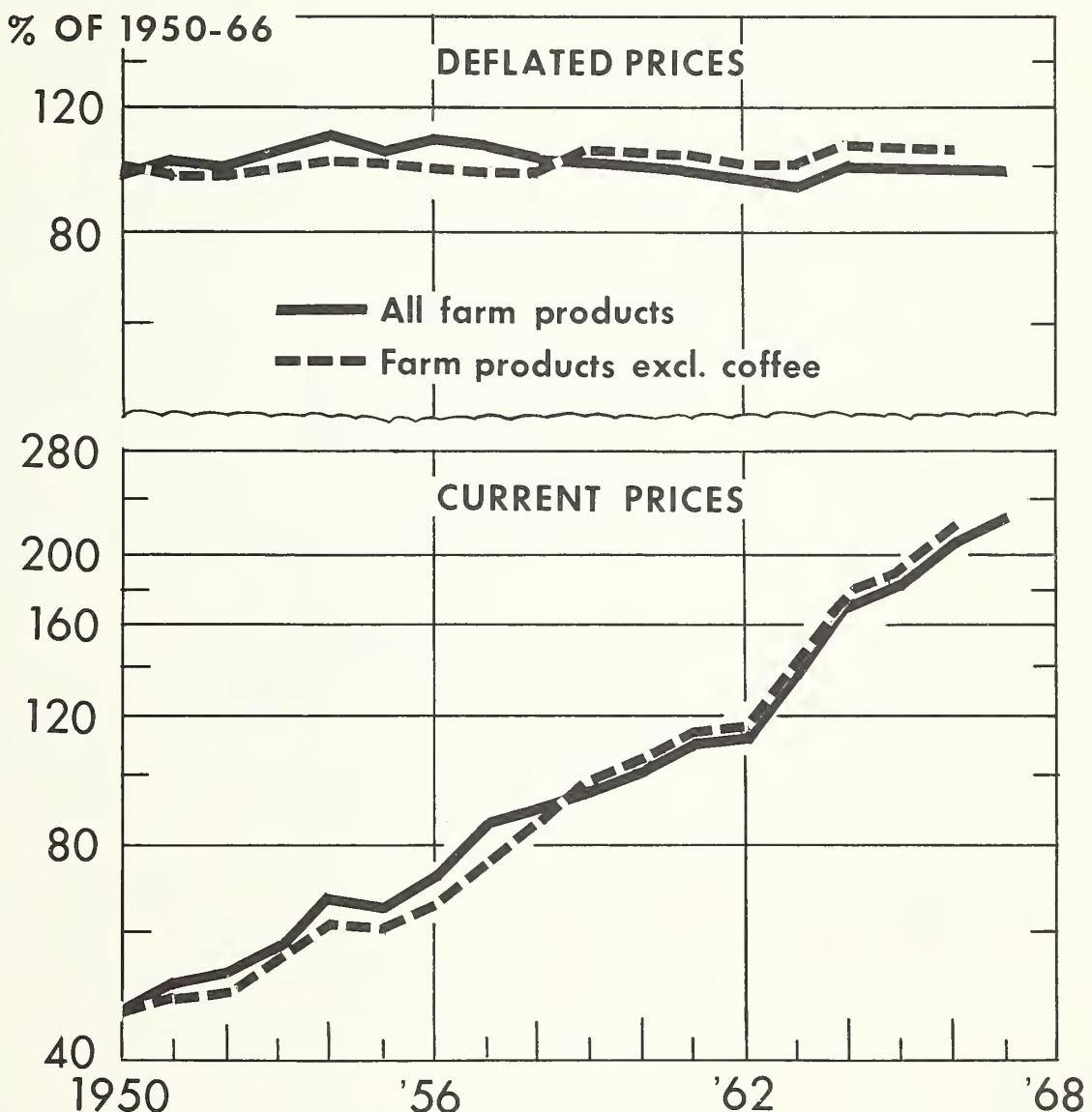
Figure 11

larger rise in agricultural prices. Since then, agricultural prices have risen less rapidly than nonagricultural prices, and the ratio of agricultural to non-agricultural prices declined in 1966 and 1967 to below the average for all of 1950-66.

Farm Prices Including and Excluding Coffee Prices

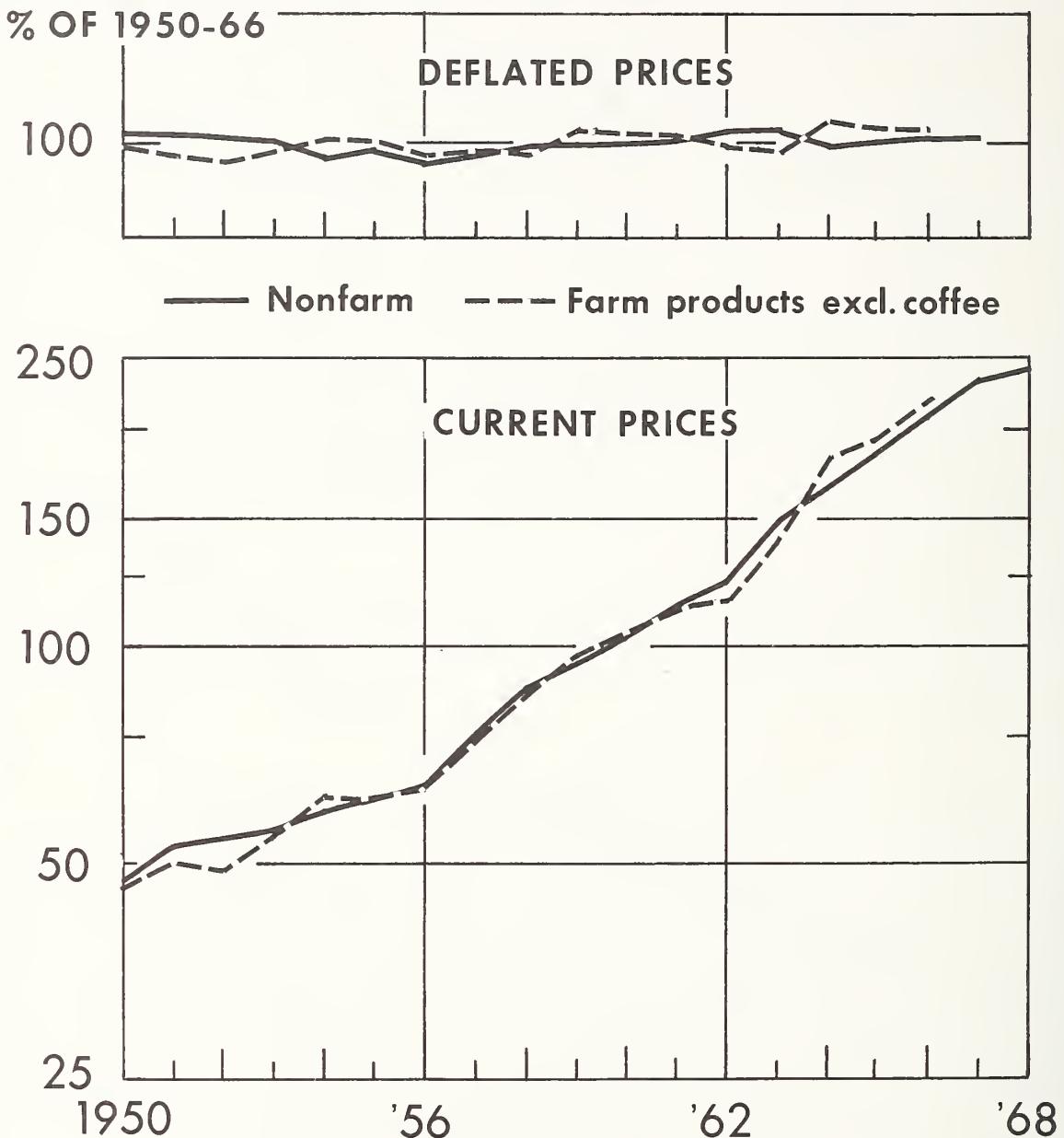
Coffee prices are so important in Colombia, and have moved so differently from other farm prices, that it is appropriate to consider agricultural price series with and without coffee (fig. 12). The two series show important differences in price movements that are perhaps most readily apparent on a deflated basis (upper panel, fig. 12). Deflated agricultural prices, excluding coffee, instead of rising to a peak in 1954, merely rose a little above the average for the period. Their next advance was in 1959. This advance had been obscured in the series of all agricultural prices by a simultaneous decline in coffee prices. The latter continued to drift downward for several years, rising briefly in 1964 and advancing more strongly in 1969-70. Although there were years of gradual decline in agricultural prices, excluding the price for coffee, the series has a general upward tendency, with the later years showing appreciably higher prices than the earlier ones. This is in contrast to the series of all agricultural prices, which shows a slight downward tendency. Comparing agricultural prices of products, excluding coffee, with all nonagricultural prices (fig. 13), the slightly faster advance for the former is shown more clearly in the bottom panel for current prices.

INDEXES OF ALL FARM PRICES AND FARM PRICES EXCLUDING COFFEE, DEFLATED AND CURRENT PRICES, COLOMBIA



THE PRICES OF FARM PRODUCTS EXCLUDING COFFEE HAVE RISEN MORE THAN THE AVERAGE OF ALL FARM PRODUCTS. SOURCE: SEE TABLE 12.

IMPLICIT PRICES OF FARM PRODUCTS EXCLUDING COFFEE AND OF NONFARM PRODUCTS, COLOMBIA



SOURCE: SEE TABLE 13.

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Figure 13

Crop and Livestock Prices

Coffee prices had an important influence on Colombian crop prices (lower panel, fig. 14) during 1950-67. In the upper panel (fig. 14), which shows deflated prices, the rise in the price of coffee between 1950 and 1956 and its subsequent decline are reflected in the average of all crops, causing this series to be higher than the average in the earlier years and lower than average during most of the later years. When coffee is excluded from the average, the trend is reversed, with a general uptrend showing after 1952. For crops excluding coffee, the principal advances occur in 1953-54, and more importantly in 1964. The advance in 1959, which was prominent for all agricultural prices excluding coffee, is of little consequence.

The advance in agricultural prices in 1959 was chiefly attributable to rising livestock prices. This can be seen in figure 15, where livestock prices are compared with prices of crops other than coffee, and with agricultural prices other than coffee. Livestock prices on a deflated basis move in cycles which result chiefly from beef cattle prices (treated in the earlier ERS report on Colombia) (5). There is no clear upward or downward trend for the livestock group. The advance in the first cattle price cycle from 1951 to 1955 clearly accentuated the 1953-54 advance of agricultural prices. The second and stronger cyclical advance from 1958 to 1960 contributed to the 1959 advance in all agricultural prices, and largely offset the relative easing in crop prices in 1960 as livestock prices reached a peak for the entire period (1950-67) on a deflated basis. A subsequent decline in deflated livestock prices extended to 1964, and largely offset soaring crop prices in 1963-64.

Crop Prices by Groups on a Deflated Basis

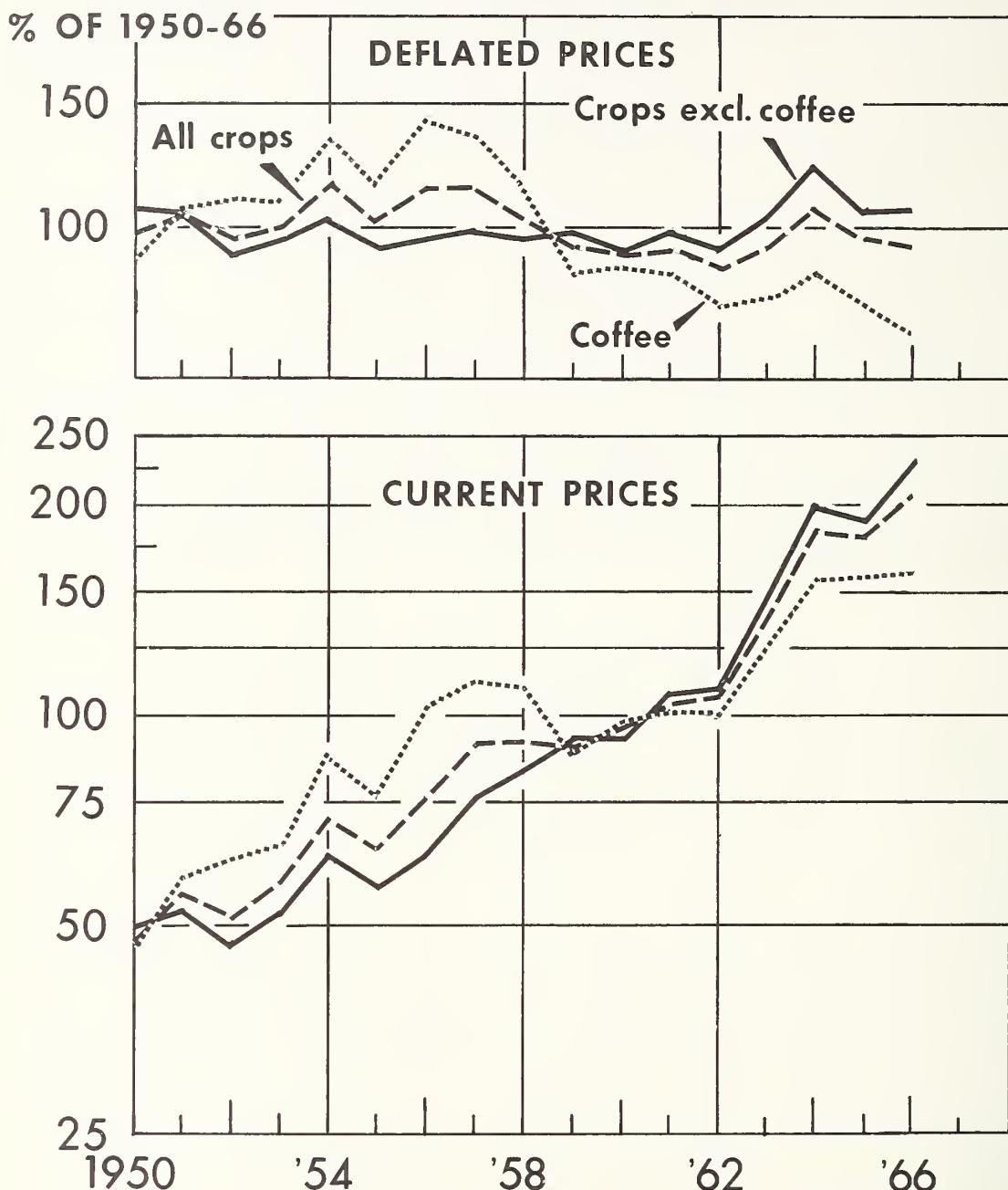
For group 1 (coffee), the outstanding price changes were the strong rise in the early 1950's and the precipitous decline beginning in 1957 and continuing through 1959. Deflated coffee prices continued to drift downward through 1967, with only a brief but significant recovery in 1964 and then a strong advance in 1969-70. The only other group which has shown a general tendency to decline is group 3, the mixed technology crops (corn, potatoes, wheat, and tobacco) (fig. 16).

The largest advance during 1950-67 was for group 2, traditional crops (yuca, beans, plantains, and noncentrifugal sugar). Prices for this group rose unusually high in 1964, and though they declined subsequently, in 1967 they were still well above the average for the entire period. Prices for group 4 (bananas and cocoa) and group 5 (cotton, rice, and sugar) showed strong advances about the middle of the period, in 1958-59. Subsequent declines that were more gradual brought them back near the average for the period.

The next step is to examine what affected price changes, and how these changes guided resource use. Per capita demand for food showed only a slight increase during 1950-67. Accordingly, it is appropriate to consider per capita production (fig. 17).

In general, there has been little direct correlation between per capita production and prices, either for groups of products or for individual products, with the possible exception of sugarcane and wheat.

IMPLICIT PRICES OF ALL CROPS, COFFEE, AND CROPS EXCLUDING COFFEE, COLOMBIA



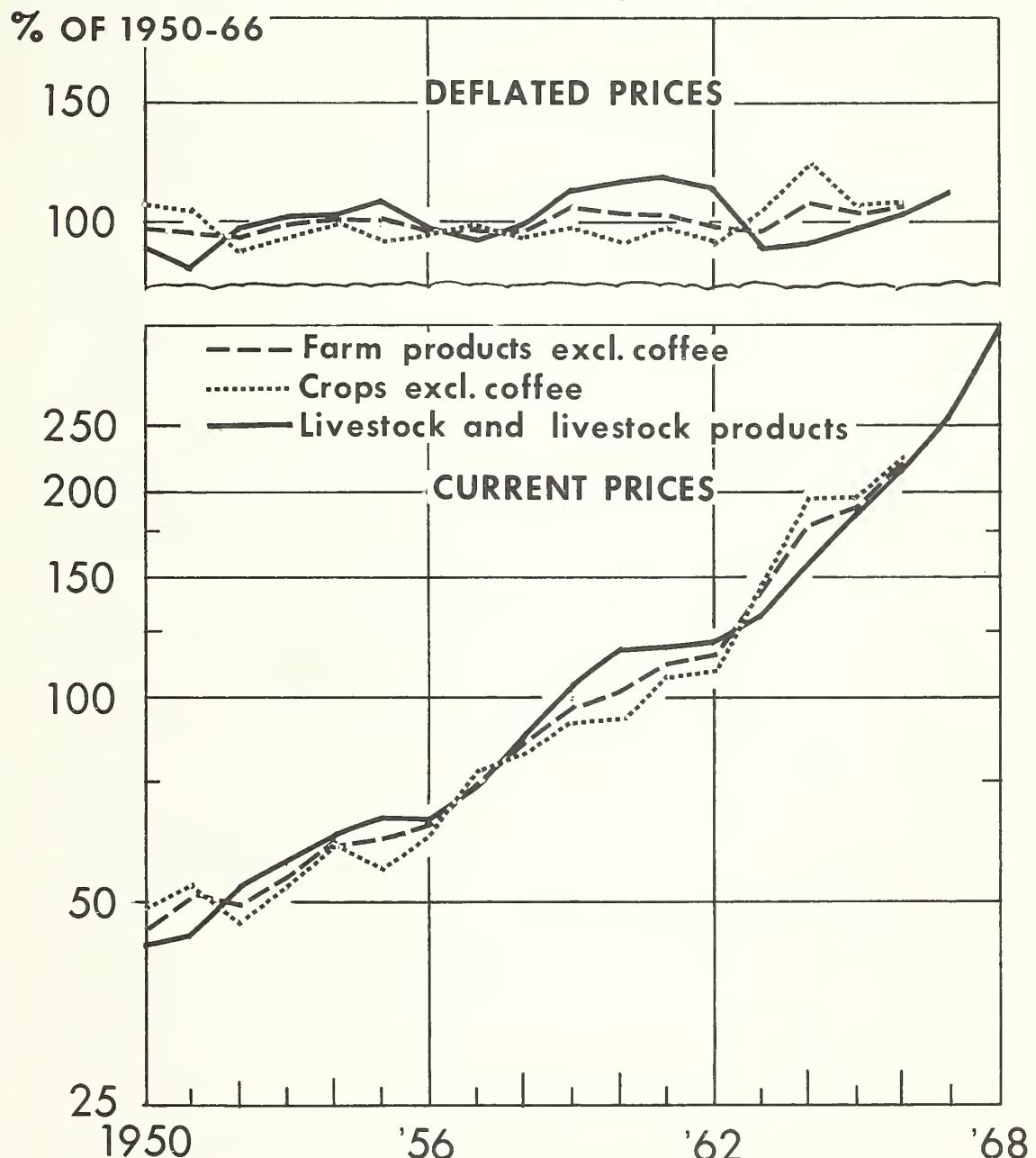
SOURCE: SEE TABLE 14.

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Figure 14

IMPLICIT PRICES OF FARM PRODUCTS AND CROPS EXCLUDING COFFEE, AND OF LIVESTOCK AND LIVESTOCK PRODUCTS, COLOMBIA



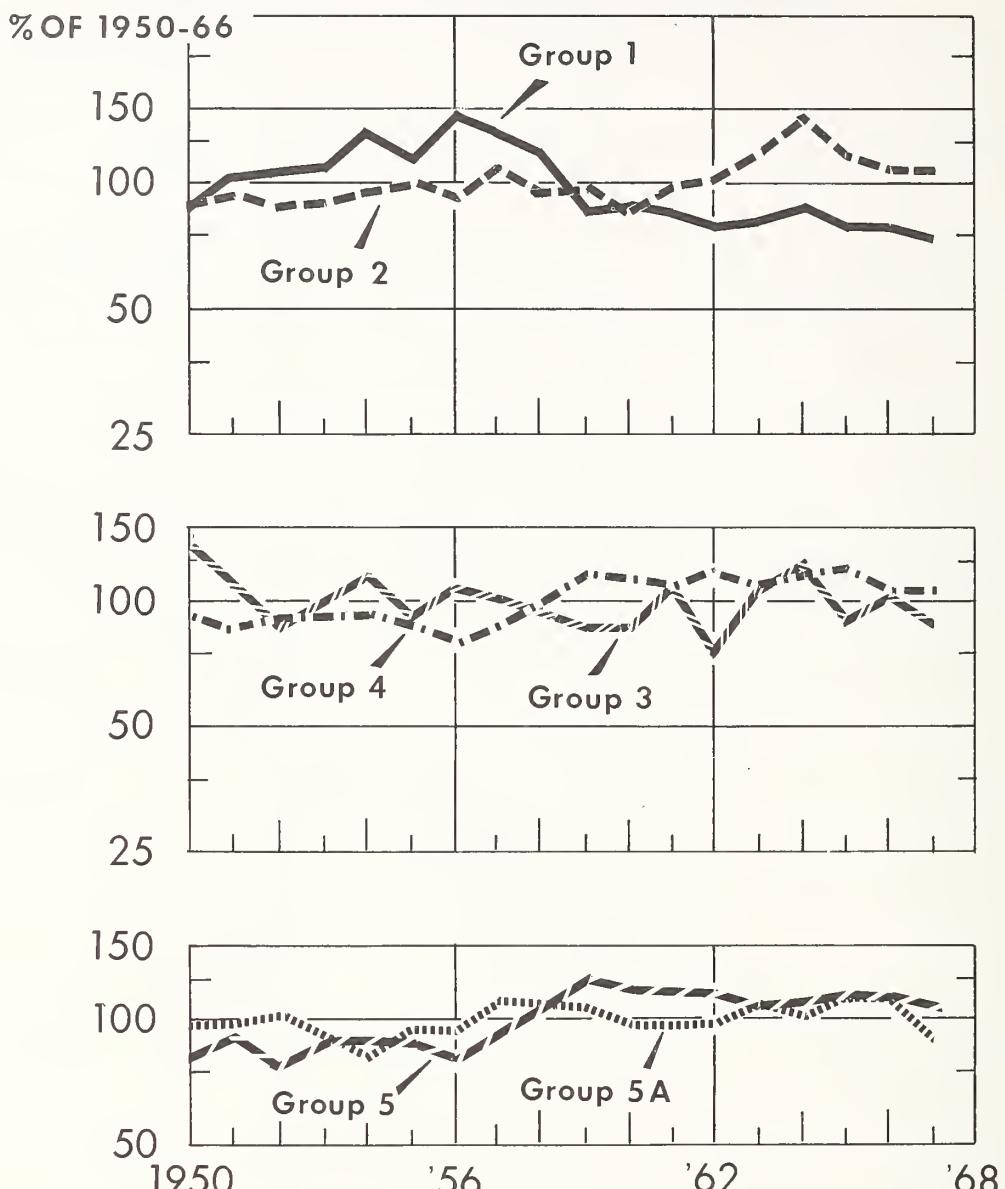
SOURCE: SEE TABLE 15.

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Figure 15

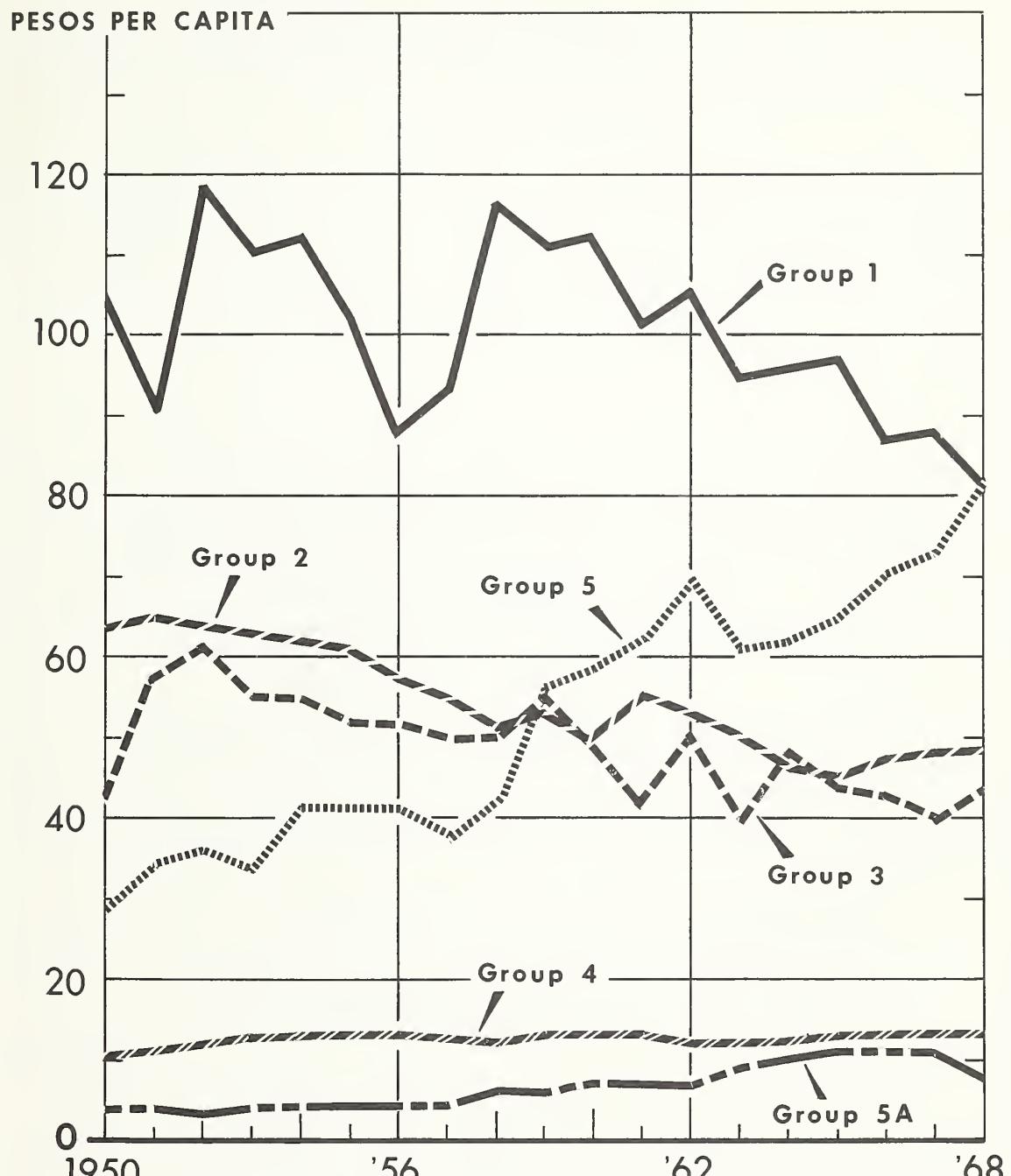
PRICES OF COLOMBIA'S MAJOR CROPS, BY GROUPS, DEFLATED BASIS



SOURCE: SEE TABLE 16.

Figure 16

PRODUCTION PER CAPITA OF COLOMBIA'S MAJOR CROPS BY GROUPS IN 1958 PRICES



SOURCE: SEE TABLE 17.

The series of real gross income per hectare has also been calculated and is shown in the charts for each group of crops. This series reflects both deflated prices and yield per hectare, the hypothesis being that this would be a better index of enterprise profitability, and thus would be more directly related to changes in area and, in turn, production.

Let us now look at each group in turn, comparing area, real gross income per hectare, and total production with prices. Where appropriate, reference will also be made to per capita production.

Group 1

For coffee, the general expectation would be that price changes which lasted for a few years would, with the appropriate lag, affect area and then production, bearing in mind that the coffee plant (tree) is a perennial. As shown in figure 18, area rose during and following the price advance of the 1950's and declined gradually after 1960 as real income per hectare continued at reduced levels until 1969.

Group 2

Prices of traditional crops -- plantains, panela, yuca, and beans -- have shown more advance than prices for any other group (fig. 19). The price movements may be divided into two distinct periods. Until 1960, deflated prices of the traditional group had shown variations but no sustained advance; neither had there been much change in area, yield, or production in this group of commodities. Since population was increasing a little more than 3 percent annually, per capita production declined. Also, a large proportion of these products is consumed on the farm, and those sold go principally to nearby local markets.

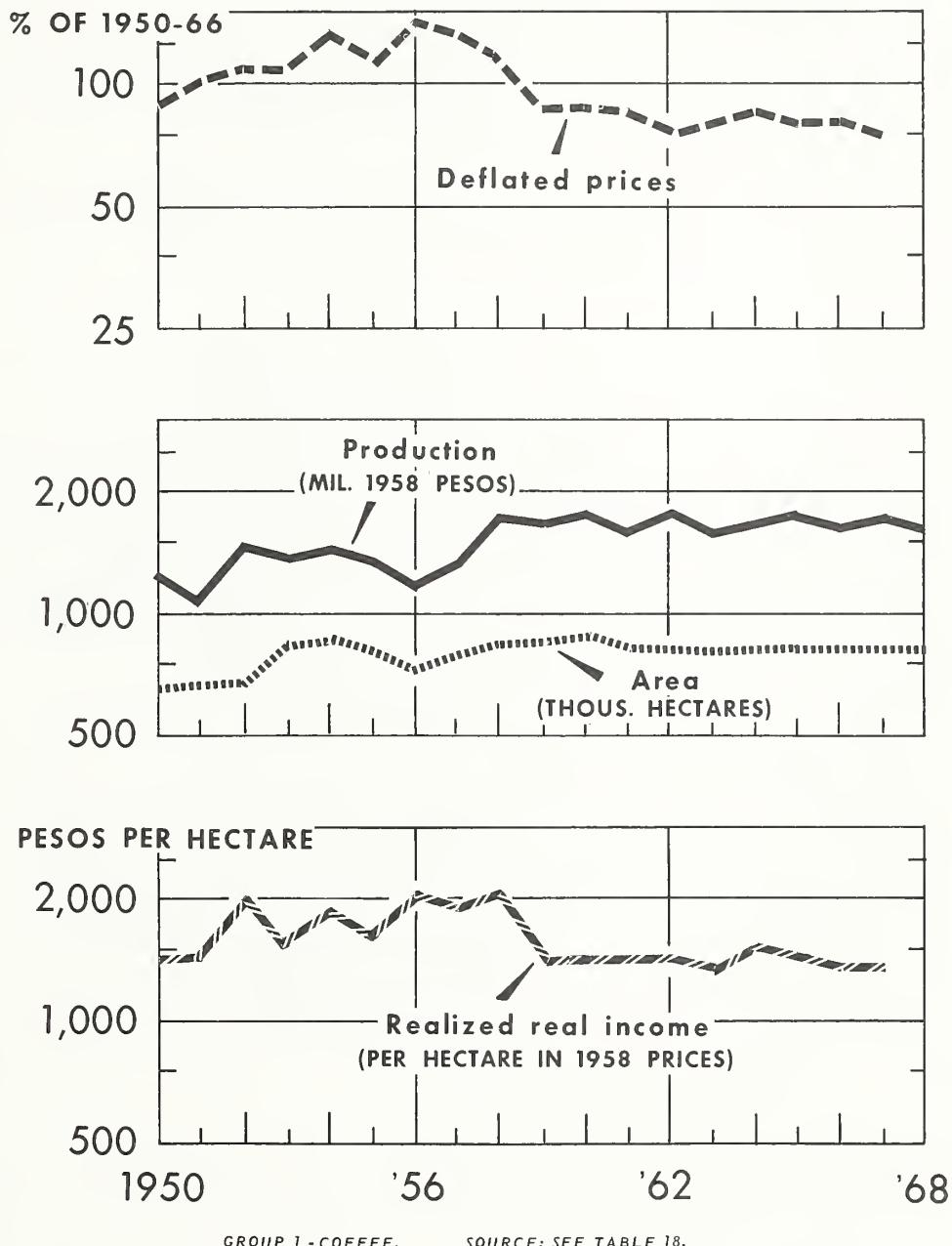
After 1960, deflated prices began to advance, showing very sharp rises in 1963 and 1964. They declined from 1965 through 1967, but the level of prices remained above the average for 1950-66. These price changes reflected changes in production in the opposite direction, as would be expected, but the price advance in 1963 and 1964 was disproportionately large in relation to the reduction in production.

There are two possible explanations. Since a rather small proportion of these products is sold, it is possible that the volume reaching the market showed a large change more or less proportional with the price fluctuations. The other possibility is that the figures are in substantial error.

There was no evidence of response in acreage to these price changes. This is not surprising, however, since the two crops which dominate the group -- plantains and panela for noncentrifugal sugar -- are both perennials and plantains are usually produced jointly with coffee. The large advance in gross income per hectare merely reflected the price advance following the severe drought in 1963, and was not an incentive to expand production. Since the products in group 2 are important food items and enter into the cost of living index, which is significant in wage bargaining, the large relative rise for this group had significant inflationary consequences.

Colombia's Major Crops

GROUP 1.--PRICES, PRODUCTION, AREA, AND REAL INCOME



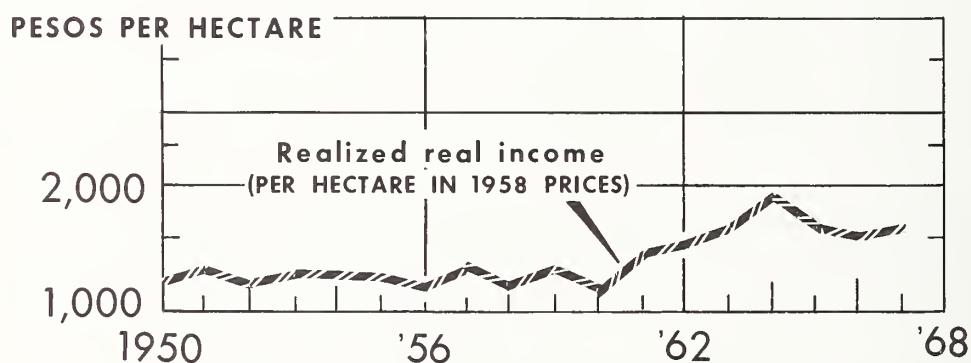
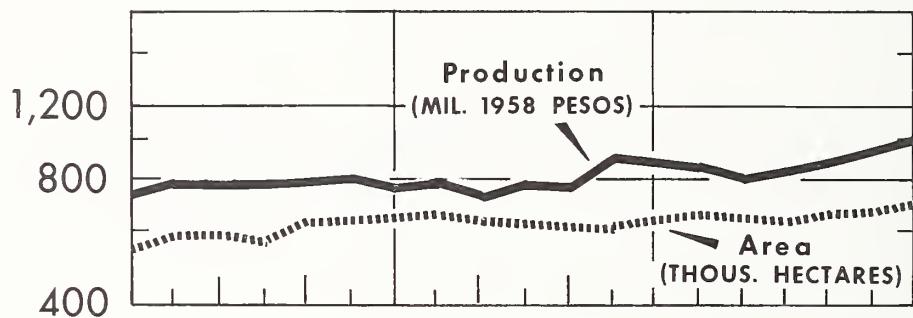
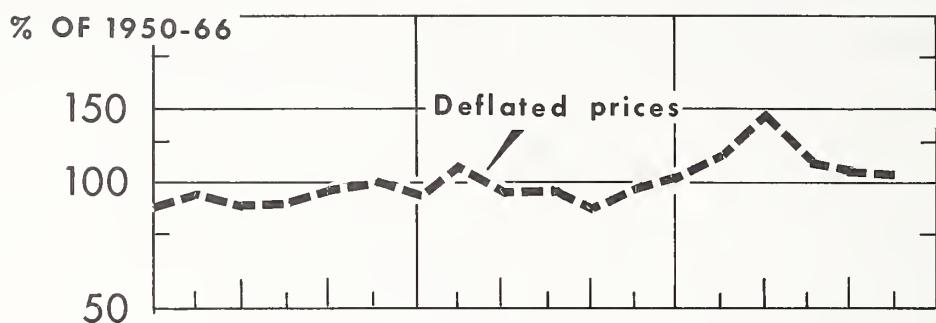
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Figure 18

Colombia's Major Crops

GROUP 2.--PRICES, PRODUCTION, AREA, AND REAL INCOME



GROUP 2--YUCA, BEANS, PLANTAINS, AND SUGAR (NONCENTRIFUGAL).

SOURCE: SEE TABLE 19.

In summary, the general price advance which is so marked for group 2 is not explained satisfactorily by the variables which have been considered. It may be noted that this largely subsistence group has been least affected by technological progress. In this respect it stands apart from the other groups, which have had reductions in varying degrees in real resource costs during the past two decades.

Group 3

Per capita production of mixed technology crops -- corn, potatoes, tobacco, and wheat -- has declined about the same as for group 2 crops, but prices have shown no general advance (fig. 20). The deflated price trend was downward from 1950 through 1962. Prices then advanced in 1963 and 1964, the rise on a deflated basis amounting to 50 percent in the 2-year period. About half of this rise was erased in the following year. Again, as in the case of group 2, the price changes are large in relation to the 10- to 15-percent annual variation in production.

At this point, it is well to remember that this crop group has been called "mixed" because each crop is produced under both traditional and nontraditional practices. But it is well named also in the sense that two different types of markets prevail for the four crops -- one for potatoes and corn, and another for tobacco and wheat. Markets for potatoes and corn are much more like those for the traditional crops (group 2). Though the markets are not strictly national in character, they are largely isolated from world markets. Imports and exports of corn and potatoes are sporadic, reflecting supply conditions within the country rather than throughout the world. Thus, when there is a short crop, and prices are an inflationary menace, an agency of the Government (IDEMA) imports the commodity to restrain the price advance. When the size of the crop is only moderately above average, prices decline, and an effort is made to export the commodity in order to support the price.

In any case, the large rise in group 3 prices in 1963-64, and the subsequent decline in 1965, reflected price changes in potatoes and corn. For potatoes, the swings were particularly wide but quite plausible in view of the shifts in production and the well-authenticated inelasticity of demand in response to supply changes. In 1962, potato production was nearly 60 percent above the 1961 level, and prices dropped from about the average for the period in 1961 to below 60 percent in 1962 before rising again during the next 2 years to 140 percent of the average for the period.

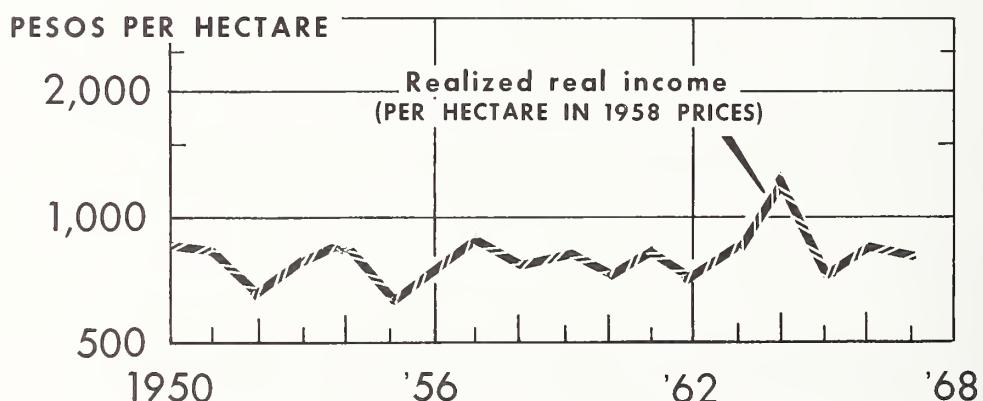
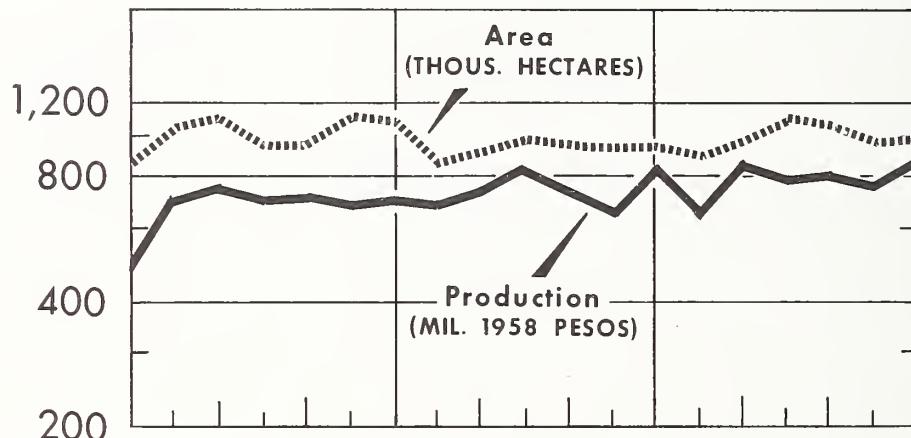
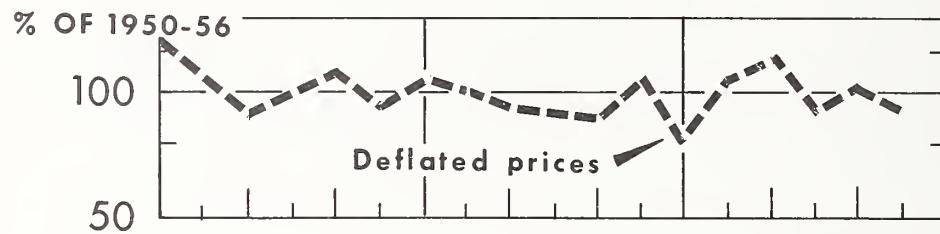
Fluctuations in corn prices were less extreme -- about equal to the 1950-66 average for the group. 6/

Wheat and tobacco prices were strongly affected by international developments. Although both declined in 1963, tobacco prices advanced strongly in 1964

6/ The Government was criticized for its effort in 1964 to increase corn production after the series of 3 short crops in 1961-63. "Operation maize" increased output about one-fifth in 1964 and brought a record crop and a distressed market situation in 1965. Nevertheless, the drop in corn prices was less than half that in potato prices.

Colombia's Major Crops

GROUP 3.-- PRICES, PRODUCTION, AREA, AND REAL INCOME



- GROUP 3-CORN, POTATOES, WHEAT, AND TOBACCO.

SOURCE: SEE TABLE 20.

and 1965, reaching a point one-fifth above the average for the period before declining in 1966 and 1967. The price advance was accompanied by sustained high production, and was attributable to reduced international supplies when Cuban exports were reduced with the advent of the Castro regime.

Deflated wheat prices showed a general downward trend from 1950 through 1963. Since then they have shown small fluctuations around a level below the average for the period (1950-66). The Colombian wheat problem is complex (discussed in (5, p. 13)). Changes in wheat prices have been attributable principally to changes in imports and pricing policy by the governmental agency responsible (IDEMA) rather than to changes in domestic production. However, the decline in price, especially in relation to other products competing for the limited supply of suitable land, has been accompanied by declining wheat seedings.

The diverse price movements in group 3 may be summarized as follows: For corn and potatoes, there has been no significant trend; just wide annual fluctuations in response to production changes. A strong downward price trend for wheat and a weaker downtrend for tobacco during the first two-thirds of 1950-67 were primarily responsible for the appreciable downtrend in the average for the group. In recent years, wheat has remained well below the average for the period, whereas tobacco has been through a full cycle, primarily because of international developments.

Group 4

Production-price comparisons for plantation-type tree crops -- bananas and cocoa -- are not so directly meaningful (fig. 21), especially in view of the complex disease problem which has confronted banana producers, and necessitated a complete shift in production areas. Although banana prices showed a larger advance than cocoa prices, the prominent price rise in 1959 affected both products. The subsequent price decline -- especially since 1961 -- reflected a strong secular downtrend in cocoa prices. The small acreage in cocoa was stable during the first half of the period, increasing slightly in recent years.

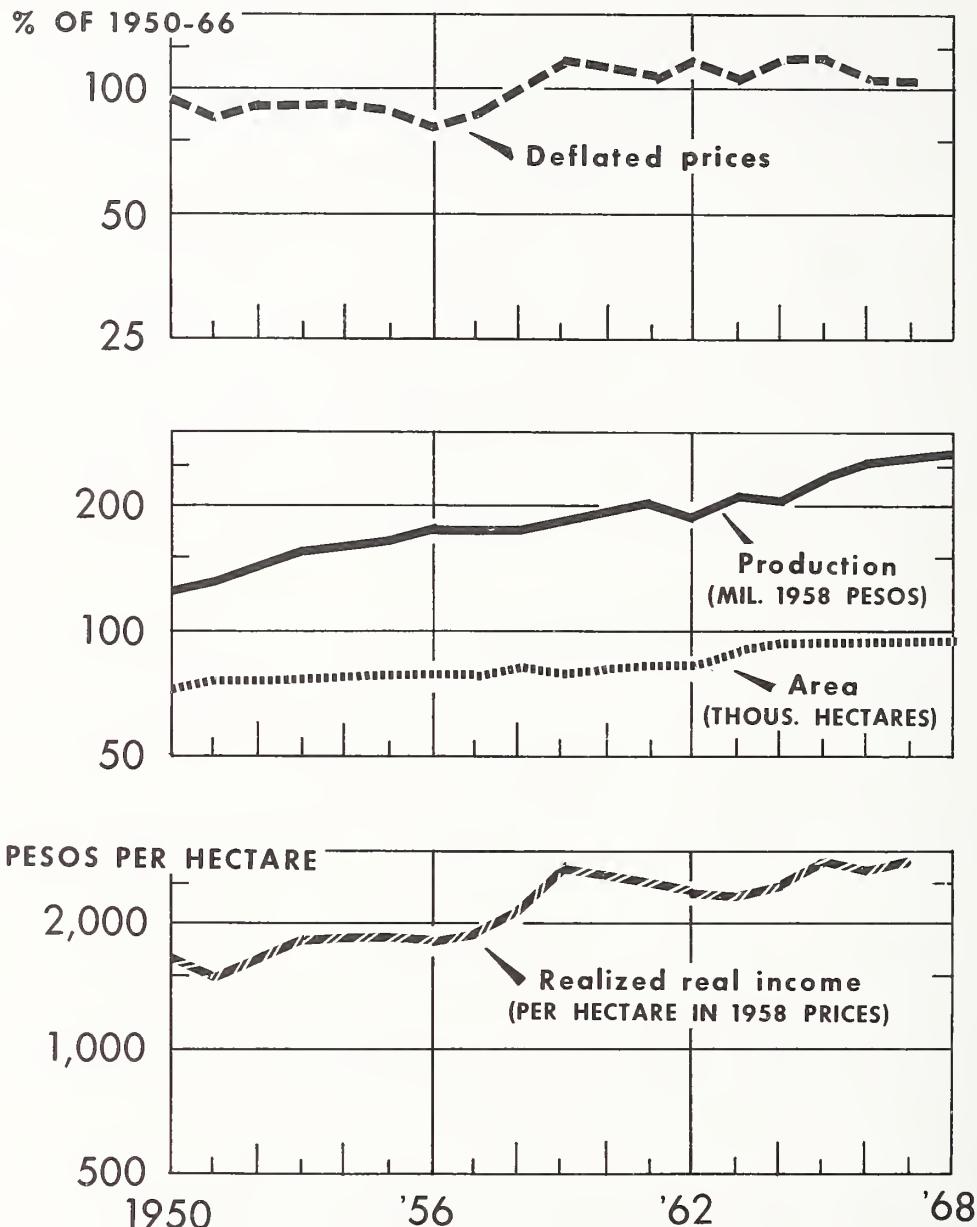
Groups 5 and 5A

Both groups, whose crops are grown under relatively modern technology, have had strong uptrends in production, considerably more than the increase in population. These are the only crop groups in Colombia that have shown such a rise. Both have had an important yield increase.

Group 5 -- cotton, rice, and sugarcane -- prices were considerably higher during the last decade than before 1957 (fig. 22). They peaked in 1959 and have since drifted downward. In 1967, however, they were still above the average for 1950-66. Real income per hectare shows the same general pattern, but the increase in the latter part of the period was much greater than the price rise. The real-income level was influenced by a strong rise in yields, with increased cotton yields being the most important. Although the price rise in group 2 was greater than in group 5, the rise in real income per hectare was greater and was well sustained for group 5. In addition, markets for the

Colombia's Major Crops

GROUP 4.-- PRICES, PRODUCTION, AREA, AND REAL INCOME



GROUP 4 - BANANAS AND COCOA.

SOURCE: SEE TABLE 21.

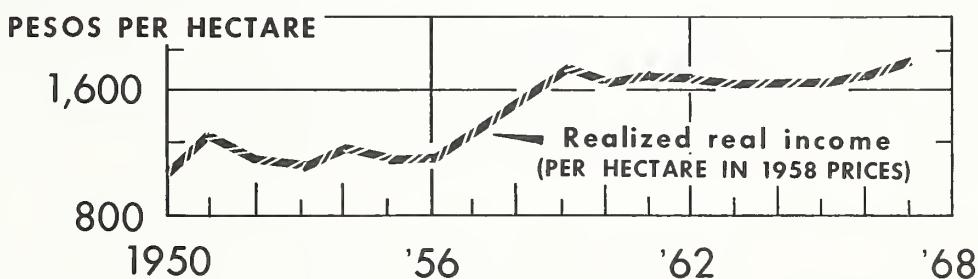
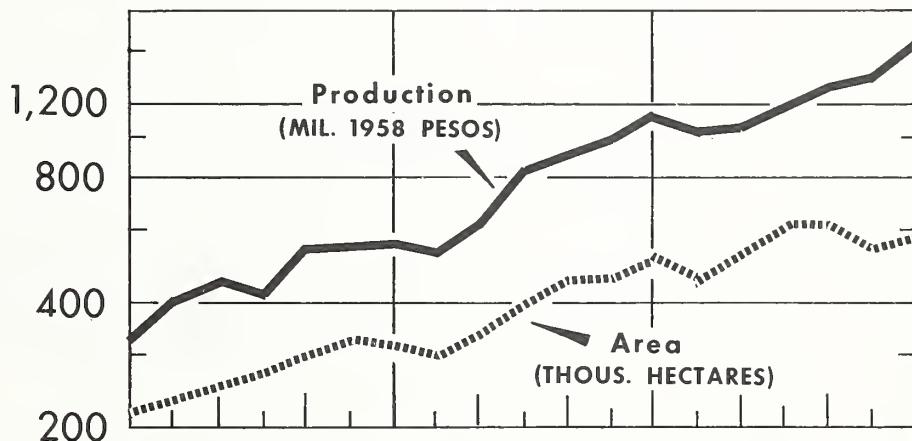
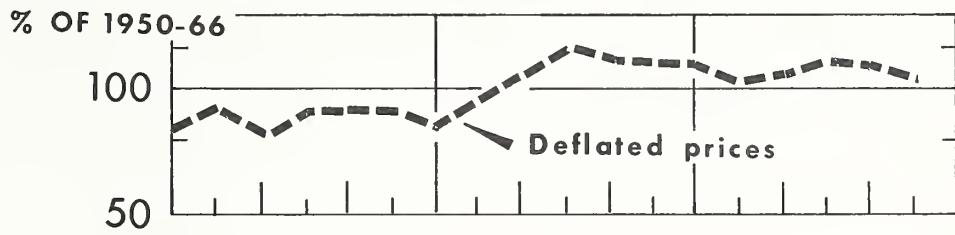
U.S. DEPARTMENT OF AGRICULTURE

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Figure 21

Colombia's Major Crops

GROUP 5.--PRICES, PRODUCTION, AREA, AND REAL INCOME



GROUP 5 - COTTON, RICE, AND CANE FOR SUGAR.

SOURCE: SEE TABLES 22.

products of group 5 were broader, better organized, and less subject to risk. Producers organizations, in close cooperation with the Government, lent stability and support to prices. Accordingly, expansion was possible without fear of spoiling the market. With relatively modern equipment and nontraditional inputs available to group 5 producers, whose acreages are much larger than those of the traditional crop producers, prices and yields were sufficiently high to be a real incentive to expansion.

The recent market situation for each of the three crops in group 5 is of special interest. Rice is still produced mainly for the domestic market, with imports and exports occurring occasionally. The domestic price is above the world export price, and exports have been on a small scale only. On the other hand, a considerable portion of the cotton produced is exported, under only the limited export subsidy that is available for all other "minor" exports (that is, excluding coffee, petroleum and products, and raw hides).

The market situation for sugar is considerably more complex. Expansion in sugar production in the fertile Cauca valley was undertaken during the period of high prices following the advent of the Castro regime in Cuba. In recent years, world sugar prices have fallen to unusually low levels. However, the price received for sugarcane has declined only moderately, and remains above the average price for 1950-66. This is the result of a price policy by a refinery group which provides a blended price for sugarcane based on: (1) a protected domestic price, somewhat similar to that of the United States; (2) a price for the sugar sold to the United States under an allotted quota; and (3) a price for the sugar exported to other countries, which is much lower than the other two prices. Toward the end of 1968, an international sugar agreement was negotiated. This agreement provides for a range of sugar prices that is intermediate between the low world sugar prices prior to the agreement and the higher prices for U.S. quota imports and for the Colombian domestic market.

During 1950-67, the situation was generally similar for group 5A -- sesame, soybeans, grain sorghum, and barley. Prices showed little uptrend, but real income per hectare advanced strongly, along with a rapid expansion in area and production (fig. 23). Among crops in group 5A, barley is an exception in that its price trend was downward and expansion in acreage and production was more limited. Barley also differs in being the only cool climate crop in the group. The others are grown mainly as rotation crops with cotton and rice (at least in Tolima). Much of the same mechanical equipment is used for each crop. Non-traditional inputs are generally employed.

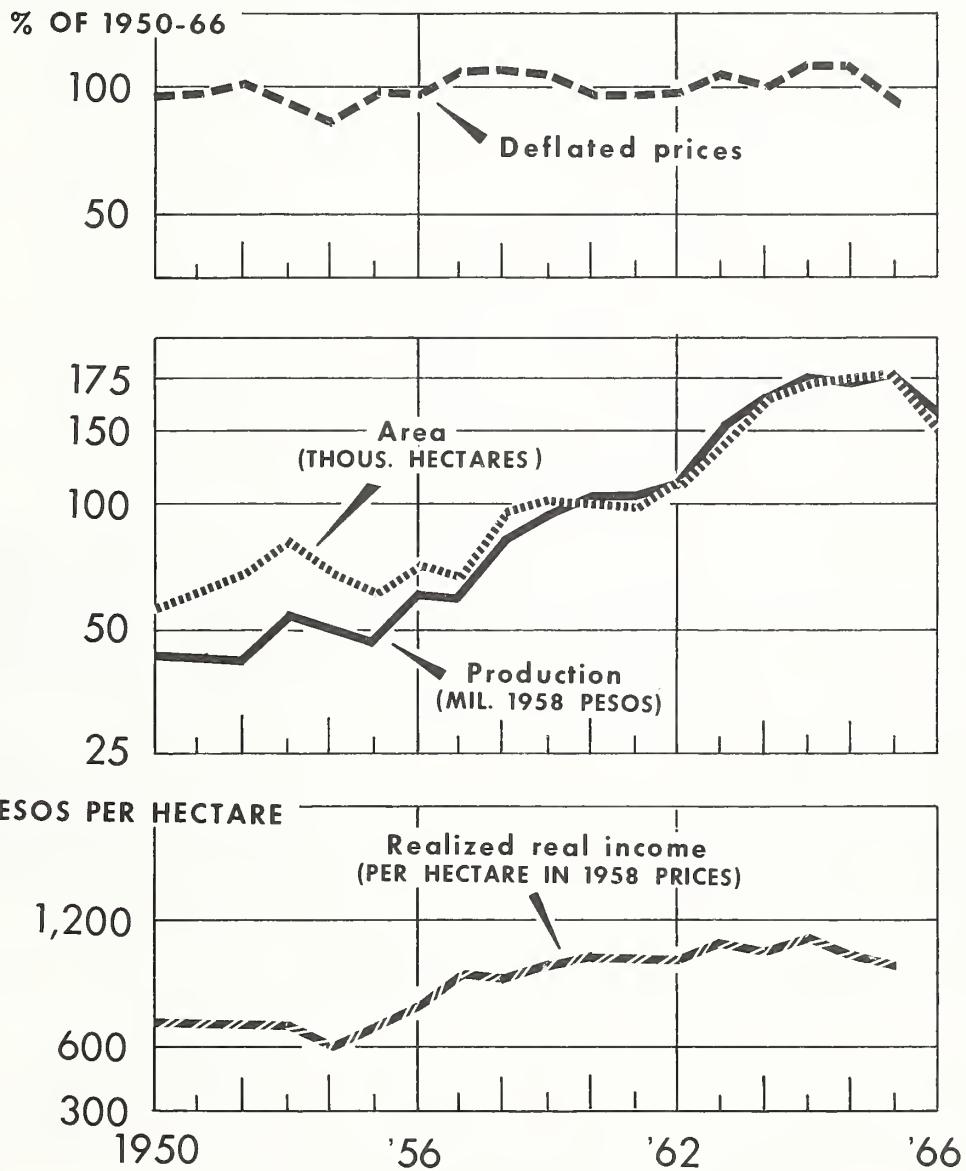
Fertilizer and Crop Prices

The principal information available on inputs is for chemical fertilizers. All fertilizers were imported prior to 1963, with negligible tariffs being assessed.

During the period 1950-62, prices of fertilizer on a deflated basis showed considerable variation but no appreciable uptrend or downtrend, according to the available information (fig. 24).

Colombia's Major Crops

GROUP 5A-- PRICES, PRODUCTION, AREA, AND REAL INCOME



GROUP 5A - SESAME, BARLEY, SOYBEANS, AND SORGHUM.

SOURCE: SEE TABLE 23.

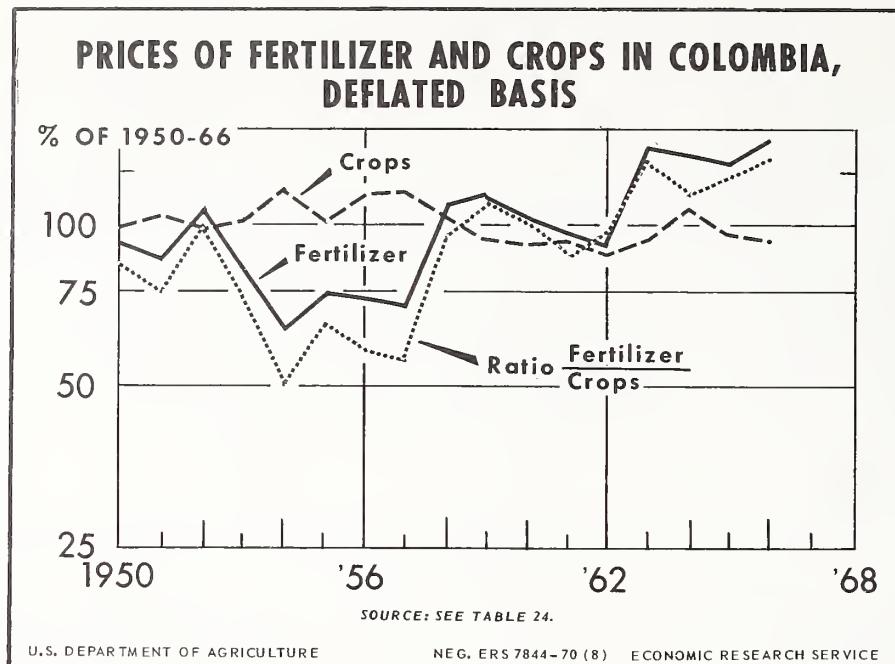


Figure 24

Fertilizer prices declined sharply in 1953-54 and then rose equally sharply in 1958, after which they remained rather stable through 1962. During most of 1950-62, the quantity imported was rather small, rising to 100,000 tons for the first time in 1955, and advancing slowly and unevenly through 1960. Imports rose to around 170,000 tons in 1961 and 1962.

Then, with the initiation of domestic production, both the quantity available and the price advanced sharply. In 1964, fertilizer tonnage reached 270,000 tons and showed little further change during the subsequent years through 1968. The price advance in 1963 was about 50 percent on a deflated basis; this price level has not changed significantly since then.

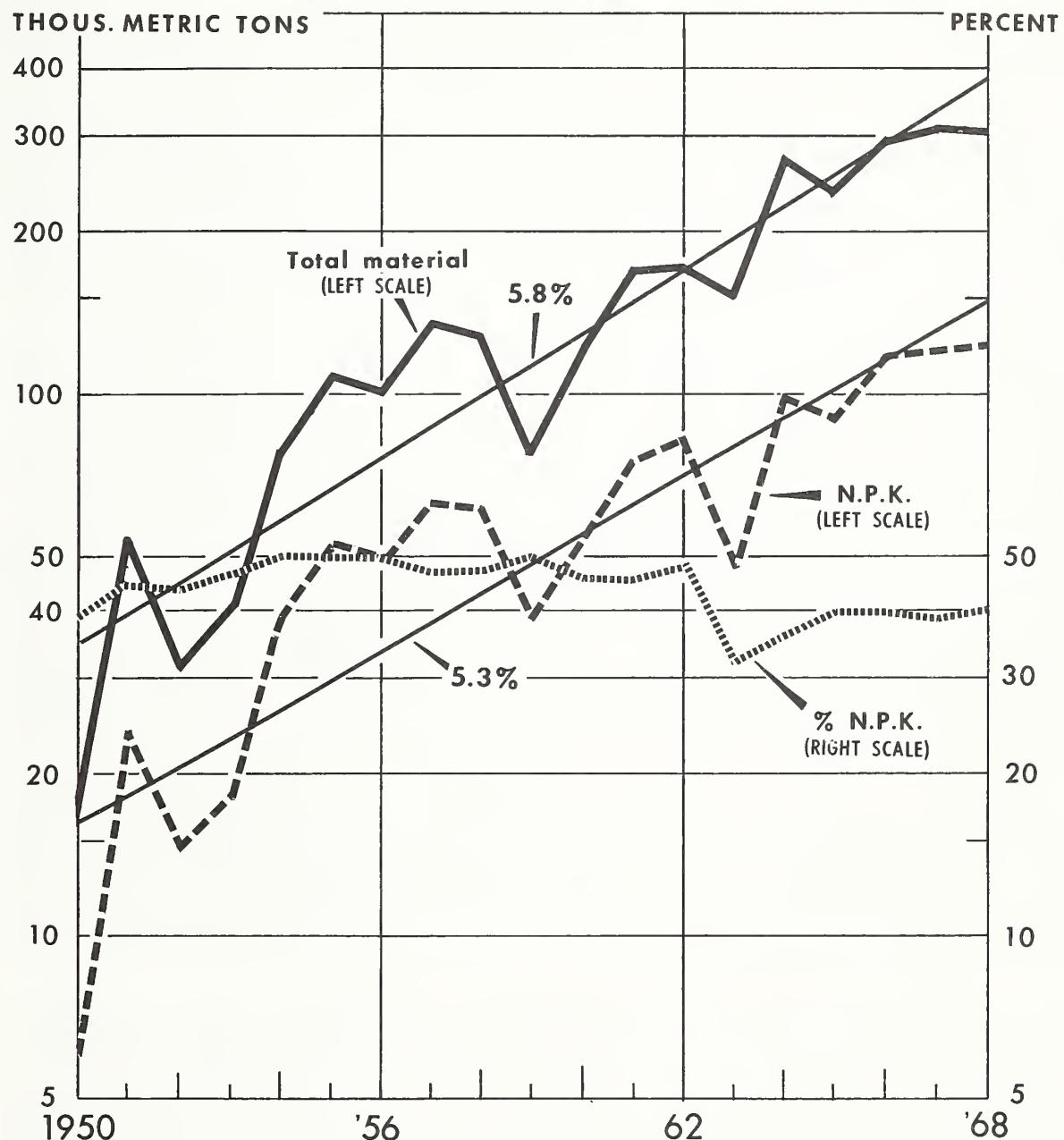
Although prices have remained at a plateau since 1963, the nutrient content has declined for several years.

The three principal nutrients (N, P₂O₅, and K₂O) accounted for around 50 percent of the fertilizer tonnage sold for the years 1954 through 1962 (fig. 25). In recent years, nutrients have usually constituted less than 40 percent of the tonnage sold, dropping as low as 32 percent in 1963. ^{7/}

The relationship of fertilizer prices to crop prices is not clearcut. Since their substantial increase in 1963, fertilizer prices have been higher in relation to crop prices than before that date. This price relationship has

^{7/} Calculated from reports filed with the Colombian Ministry of Agriculture by all fertilizer producers in Colombia.

FERTILIZER AVAILABLE FOR CONSUMPTION IN COLOMBIA, PRIMARY NUTRIENTS (NPK₂) AND NPK AS PERCENTAGE OF TOTAL MATERIAL



SOURCE: SEE TABLE 29.

Figure 25

also been less favorable for fertilizer usage than in major countries producing and exporting fertilizer. Nonprice factors affecting fertilizer consumption are discussed on pages 64-70.

Summary

The questions posed at the beginning of this chapter can be answered only partially.

Each was considered in modified form, so answers could be as specific and complete as possible. For example, in analyzing whether agricultural prices were too high in relation to nonagricultural prices, the standard of the average relationship for the full period 1950-66 was used. For the question of whether prices had been too low to be an effective incentive for farmers, it was necessary to consider separately the various crop groups, since they showed varying response to price changes.

Farm prices including coffee prices did not rise faster than nonfarm prices during the period 1950-67. In 1967, the average of all farm prices was a little lower in relation to nonfarm prices than the average relationship for the period.

If coffee prices are excluded, however, farm prices did rise somewhat faster than nonfarm prices, especially for traditionally cultivated, group 2 crops. The three independent rises in deflated farm prices resulting from curtailed production in 1953-54, 1959, and 1963-64 were a little larger than the subsequent easing in prices following increased production.

In addition, the effects were quite likely asymmetrical. The farm price rises were absorbed into wholesale and retail food prices, and then into wages and into nonfarm prices, and so forth. This absorption occurred more quickly and fully than the translation of subsequent lower farm prices into lower prices at all distribution levels.

Some of the largest price rises occurred among the traditionally produced commodities. This was especially true of the 1- to 2-year advances that were due to reduced production. Despite the price rises, however, there was little general expansion of acreage or yield. These traditional products were sold principally in local markets which are often quite "thin" (a substantial expansion in production might lower prices).

The deflated average of prices for group 3 commodities (those produced under mixed technology) showed a tendency to decline during most of the period. This decline was interrupted following the severe drought in 1963. For the most recent years, 1965-67, the deflated average price for group 3 was a little below its 1950-66 average. Within the group, price trends and influences were very diverse. Deflated prices of potatoes and corn fluctuated sharply from year to year, whereas wheat prices showed a strong downtrend during 1950-67 and tobacco prices a weaker downtrend during the first two-thirds of the period. Price trends for wheat and tobacco were more closely related to international factors than to domestic production.

For the commodities in groups 5 and 5A, produced with the aid of non-traditional inputs, prices were high and stable enough in better organized and supported markets to provide an incentive to expand throughout 1950-67. Improved technology and yields during the period were additional influences encouraging increased output. During the first two-thirds of the period, fertilizer prices drifted downward in relation to final product prices, but the trend has been reversed in the past several years.

Colombia's National Department of Planning (DNP), analyzing the price support policy of the Government, suggested that agricultural price supports be considered incentive prices.^{8/} An essential element of their analysis is that price supports bear a definite relation to international prices (based on the need to provide an incentive to producers). Specifically, wheat, oilseeds, and barley might be supported well above the world level (for example, 40 percent higher) to encourage production to substitute for imports. Corn, rice, soybeans, and beans are produced in about the quantity required for domestic consumption, with occasional exports or imports. Prices for these four commodities might be supported at an intermediate level, just enough above the world market to encourage appropriate production for the domestic market and to eliminate the need for imports.

Export crops might be supported at about the world market level, to avoid costly export payments.

The price policies established by the Government were considerably different from those suggested by the DNP. They had diverse purposes, such as creating incentives for producers and establishing ceilings to hold down prices for workers. However, the Government was ineffective in carrying out these price policies.

^{8/} 1967, unpublished manuscript.

Table 8.--Consumers' prices: Index numbers of prices paid by salaried employees, Colombia, 1954-68

(July 1954-June 1955=100)

| Year | First quarter | | Second quarter | | Third quarter | | Fourth quarter | |
|---------|----------------|-------------|----------------|-------------|----------------|-------------|----------------|-------------|
| | : Change from: | | : Change from: | | : Change from: | | : Change from: | |
| | Index | : preceding |
| | : quarter | : |
| Percent | | | | | | | | |
| 1954... | | | | | 99.6 | | 99.5 | -0.1 |
| 1955... | 100.1 | 0.6 | 100.8 | 0.7 | 100.8 | 0.0 | 101.7 | 0.9 |
| 1956... | 102.3 | 0.6 | 104.9 | 2.5 | 106.8 | 1.8 | 109.4 | 2.4 |
| 1957... | 112.5 | 2.8 | 118.4 | 5.2 | 126.6 | 6.9 | 130.3 | 2.9 |
| 1958... | 132.3 | 1.5 | 137.4 | 3.9 | 140.0 | 1.9 | 141.7 | 1.2 |
| 1959... | 145.0 | 2.3 | 148.9 | 2.7 | 151.5 | 1.7 | 152.8 | 0.9 |
| 1960... | 154.5 | 1.1 | 157.5 | 1.9 | 159.7 | 1.4 | 162.8 | 1.9 |
| 1961... | 166.5 | 2.3 | 171.7 | 3.1 | 172.6 | 0.5 | 173.4 | 0.5 |
| 1962... | 176.1 | 1.6 | 179.3 | 1.8 | 182.1 | 1.6 | 185.1 | 1.6 |
| 1963... | 203.0 | 9.7 | 225.0 | 10.8 | 232.1 | 3.2 | 239.6 | 3.2 |
| 1964... | 248.9 | 3.9 | 263.1 | 5.7 | 264.9 | 0.7 | 263.7 | -0.5 |
| 1965... | 268.5 | 1.8 | 278.7 | 3.8 | 285.5 | 2.4 | 298.5 | 4.6 |
| 1966... | 313.2 | 4.9 | 330.2 | 5.4 | 335.0 | 1.5 | 342.5 | 2.2 |
| 1967... | 349.0 | 1.9 | 356.8 | 2.2 | 363.6 | 1.9 | 369.0 | 1.5 |
| 1968... | 375.4 | 1.7 | 386.3 | 2.9 | 391.0 | 1.2 | 394.4 | 0.9 |

Source: Departamento Administrativo Nacional de Estadística, "Boletín Mensual de Estadística," Bogotá, Colombia.

Table 9.--Consumers' prices: Index numbers of prices paid by workers, Colombia, 1954-68

(July 1954-June 1955=100)

| Year | First quarter | | Second quarter | | Third quarter | | Fourth quarter | |
|---------|----------------|-------------|----------------|-------------|----------------|-------------|----------------|-------------|
| | : Change from: | | : Change from: | | : Change from: | | : Change from: | |
| | Index | : preceding |
| | : quarter | : |
| Percent | | | | | | | | |
| 1954... | | | | | 100.3 | | 99.6 | -0.7 |
| 1955... | 99.4 | -0.2 | 100.4 | 1.0 | 99.6 | -0.8 | 100.5 | 0.9 |
| 1956... | 102.2 | 1.7 | 104.6 | 2.3 | 106.3 | 1.6 | 109.3 | 2.8 |
| 1957... | 113.2 | 3.6 | 120.8 | 6.7 | 129.2 | 7.0 | 132.6 | 2.6 |
| 1958... | 134.6 | 1.5 | 140.7 | 4.5 | 142.8 | 1.5 | 143.7 | 0.6 |
| 1959... | 147.6 | 2.7 | 152.1 | 3.0 | 153.6 | 1.0 | 154.1 | 0.3 |
| 1960... | 156.0 | 1.2 | 159.8 | 2.4 | 161.3 | 0.9 | 164.9 | 2.2 |
| 1961... | 169.1 | 2.5 | 176.8 | 4.6 | 175.6 | -0.7 | 175.0 | -0.3 |
| 1962... | 177.3 | 1.3 | 180.8 | 2.0 | 182.8 | 1.1 | 185.3 | 1.4 |
| 1963... | 205.9 | 11.1 | 230.8 | 12.1 | 238.2 | 3.2 | 249.3 | 4.7 |
| 1964... | 259.3 | 4.0 | 278.3 | 7.3 | 277.3 | -0.4 | 273.4 | -1.4 |
| 1965... | 277.6 | 1.5 | 287.9 | 3.7 | 292.9 | 1.7 | 306.7 | 4.7 |
| 1966... | 322.9 | 5.3 | 342.6 | 6.1 | 343.4 | 0.2 | 350.8 | 2.2 |
| 1967... | 357.2 | 1.8 | 365.6 | 2.4 | 370.5 | 1.3 | 376.0 | 1.5 |
| 1968... | 383.0 | 1.9 | 394.4 | 3.0 | 398.8 | 1.1 | 401.8 | 0.8 |

Source: Departamento Administrativo Nacional de Estadística, "Boletín Mensual de Estadística," Bogotá, Colombia.

Table 10.--Three comprehensive price indexes: all wholesale, consumers', and implicit price deflators for gross domestic products, Colombia, 1950-68

(1958=100)

| Year | : Implicit price deflators : for gross domestic product 1/ | : All wholesale prices 2/ | : Consumers' prices : paid by salaried : employees 3/ |
|------------|--|------------------------------|---|
| 1950.....: | 53.5 | 52.0 | -- |
| 1951.....: | 59.0 | 56.1 | -- |
| 1952.....: | 59.9 | 55.5 | -- |
| 1953.....: | 62.8 | 58.8 | -- |
| 1954.....: | 69.9 | 62.8 | 72.2 |
|: | | | |
| 1955.....: | 69.8 | 63.8 | 73.2 |
| 1956.....: | 75.3 | 68.6 | 76.9 |
| 1957.....: | 88.2 | 85.2 | 88.4 |
| 1958.....: | 100.0 | 100.0 | 100.0 |
| 1959.....: | 106.6 | 109.6 | 108.5 |
|: | | | |
| 1960.....: | 115.7 | 114.2 | 115.0 |
| 1961.....: | 125.2 | 121.7 | 124.1 |
| 1962.....: | 133.5 | 124.9 | 131.0 |
| 1963.....: | 164.5 | 157.7 | 163.1 |
| 1964.....: | 191.4 | 185.3 | 188.6 |
|: | | | |
| 1965.....: | 208.9 | 200.6 | 205.1 |
| 1966.....: | 240.1 | 235.5 | 239.4 |
| 1967.....: | 261.4 | 251.6 | 260.8 |
| 1968.....: | -- | 267.3 | 280.5 |
|: | | | |

Note: -- = N.A.

1/ Banco de la Repblica, Departamento de Investigaciones Econmicas, Cuentas Nacionales, Colombia.

2/ Ibid. Revista Mensual del Banco de la Repblica.

3/ Ibid.

Table 11.--Implicit price deflators, farm and nonfarm, Colombia, 1939-67

(1958=100)

| Year | Farm | Nonfarm | Ratio: Farm Nonfarm |
|------------|-------|---------|---------------------------|
| 1939 | | | 62.9 |
| 1940 | | | 51.2 |
| 1941 | | | 54.7 |
| 1942 | | | 59.7 |
| 1943 | | | 65.1 |
| 1944 | | | 73.9 |
| 1945 | | | 66.4 |
| 1946 | | | 68.9 |
| 1947 | | | 77.9 |
| 1948 | | | 69.5 |
| 1949 | | | 76.1 |
| 1950 | 50.8 | 55.1 | 92.2 |
| 1951 | 57.1 | 60.2 | 94.9 |
| 1952 | 57.8 | 61.2 | 94.4 |
| 1953 | 62.5 | 63.0 | 99.2 |
| 1954 | 75.0 | 67.3 | 111.4 |
| 1955 | 71.4 | 69.1 | 103.3 |
| 1956 | 79.9 | 73.0 | 109.5 |
| 1957 | 92.9 | 85.8 | 108.3 |
| 1958 | 100.0 | 100.0 | 100.0 |
| 1959 | 104.4 | 107.8 | 96.8 |
| 1960 | 112.9 | 117.0 | 96.5 |
| 1961 | 120.7 | 127.3 | 94.8 |
| 1962 | 124.2 | 137.8 | 90.1 |
| 1963 | 152.7 | 169.7 | 90.0 |
| 1964 | 192.4 | 191.0 | 100.7 |
| 1965 | 203.8 | 211.0 | 96.6 |
| 1966 | 232.5 | 243.2 | 95.6 |
| 1967 | 252.0 | 265.3 | 95.0 |

Source: 1939-49, Albert Berry, unpublished manuscript. 1950-66 calculations based on data from national accounts estimates, Banco de la República, Colombia.

Table 12.--Implicit prices, all farm products, 1950-67, and farm products excluding coffee, 1950-66, Colombia

(1950-66=100)

| Year | Farm products | | Farm products, excluding coffee | |
|-----------|---------------|----------|---------------------------------|----------|
| | Current | Deflated | Current | Deflated |
| 1950..... | 45.7 | 96.1 | 45.8 | 98.1 |
| 1951..... | 51.3 | 97.9 | 49.7 | 96.6 |
| 1952..... | 52.0 | 97.6 | 49.3 | 94.3 |
| 1953..... | 56.2 | 100.6 | 54.0 | 98.6 |
| 1954..... | 67.4 | 108.5 | 61.7 | 101.2 |
| 1955..... | 64.2 | 103.4 | 60.8 | 99.9 |
| 1956..... | 71.9 | 107.3 | 63.7 | 97.0 |
| 1957..... | 83.5 | 106.5 | 75.0 | 97.5 |
| 1958..... | 89.9 | 101.1 | 85.0 | 97.4 |
| 1959..... | 93.9 | 99.0 | 96.8 | 104.0 |
| 1960..... | 101.5 | 98.7 | 102.9 | 101.9 |
| 1961..... | 108.5 | 97.5 | 111.3 | 101.8 |
| 1962..... | 111.7 | 94.0 | 115.0 | 98.6 |
| 1963..... | 137.3 | 93.8 | 141.1 | 98.3 |
| 1964..... | 173.0 | 101.6 | 178.1 | 106.6 |
| 1965..... | 183.3 | 98.7 | 189.8 | 104.1 |
| 1966..... | 209.1 | 97.9 | 219.7 | 104.9 |
| 1967..... | 226.6 | 97.5 | | |

Source: Derived from national accounts estimates, Banco de la República, Colombia.

Table 13.--Implicit prices of farm products excluding coffee, 1950-66, and of nonfarm products, 1950-68, Colombia

(1950-66=100)

| Year | Farm products, excluding coffee | | Nonfarm products | |
|-----------|---------------------------------|----------|------------------|----------|
| | Current | Deflated | Current | Deflated |
| 1950..... | 45.8 | 98.1 | 48.3 | 102.4 |
| 1951..... | 49.7 | 96.6 | 52.8 | 101.4 |
| 1952..... | 49.3 | 94.3 | 53.6 | 101.6 |
| 1953..... | 54.0 | 98.6 | 55.2 | 99.7 |
| 1954..... | 61.7 | 101.2 | 59.0 | 95.7 |
| 1955..... | 60.8 | 99.9 | 60.6 | 98.4 |
| 1956..... | 63.7 | 97.0 | 64.0 | 96.3 |
| 1957..... | 75.0 | 97.5 | 75.2 | 96.7 |
| 1958..... | 85.0 | 97.4 | 87.6 | 99.4 |
| 1959..... | 96.8 | 104.0 | 94.5 | 100.5 |
| 1960..... | 102.9 | 101.9 | 102.5 | 100.5 |
| 1961..... | 111.3 | 101.8 | 111.6 | 101.1 |
| 1962..... | 115.0 | 98.6 | 120.8 | 102.6 |
| 1963..... | 141.1 | 98.3 | 148.7 | 102.6 |
| 1964..... | 178.1 | 106.6 | 167.4 | 99.2 |
| 1965..... | 189.8 | 104.1 | 184.9 | 100.4 |
| 1966..... | 219.7 | 104.9 | 213.1 | 100.7 |
| 1967..... | | | 232.5 | |
| 1968..... | | | 1/242.2 | 100.9 |

1/ Estimated.

Source: Derived from national accounts estimates, Banco de la República, Colombia.

Table 14.--Implicit prices of all crops, crops excluding coffee, and coffee, Colombia, 1950-66

| Year | (1950-66=100) | | | | | | | |
|------|---------------|----------|-------------------------|----------|---------|----------|---------|----------|
| | All crops | | Crops, excluding coffee | | Coffee | | | |
| | Current | Deflated | Current | Deflated | Current | Deflated | Current | Deflated |
| 1950 | 47.3 | 98.7 | 49.3 | 106.3 | 45.8 | 90.0 | | |
| 1951 | 54.6 | 103.2 | 53.1 | 103.8 | 58.2 | 103.5 | | |
| 1952 | 52.3 | 97.4 | 46.8 | 90.1 | 62.1 | 108.9 | | |
| 1953 | 56.5 | 100.3 | 51.9 | 95.3 | 65.0 | 108.8 | | |
| 1954 | 71.1 | 113.5 | 61.5 | 101.5 | 87.9 | 132.2 | | |
| 1955 | 63.7 | 101.7 | 56.5 | 93.5 | 76.7 | 115.3 | | |
| 1956 | 76.6 | 113.4 | 62.5 | 95.8 | 101.4 | 141.4 | | |
| 1957 | 89.8 | 113.5 | 75.9 | 99.2 | 112.9 | 134.4 | | |
| 1958 | 92.3 | 102.9 | 83.3 | 96.1 | 108.6 | 114.0 | | |
| 1959 | 89.3 | 93.4 | 91.5 | 99.0 | 88.2 | 86.9 | | |
| 1960 | 94.6 | 91.2 | 93.2 | 92.9 | 97.3 | 88.3 | | |
| 1961 | 104.0 | 92.6 | 106.9 | 98.6 | 101.7 | 85.3 | | |
| 1962 | 105.5 | 88.2 | 108.8 | 94.0 | 99.6 | 78.3 | | |
| 1963 | 137.1 | 92.9 | 145.7 | 102.2 | 123.0 | 78.6 | | |
| 1964 | 182.5 | 106.3 | 198.3 | 119.6 | 154.8 | 84.9 | | |
| 1965 | 180.5 | 96.4 | 192.6 | 106.3 | 155.2 | 78.0 | | |
| 1966 | 203.1 | 94.3 | 221.5 | 106.4 | 162.2 | 70.9 | | |

Source: Derived from national accounts estimates, Banco de la República, Colombia.

Table 15.--Implicit prices of all farm products and crops excluding coffee, and of livestock and livestock products, Colombia, 1950-67

| Year | (1950-66=100) | | | | | | | |
|----------|-----------------------------------|----------|-------------------------|----------|-------------------------------------|----------|---------|----------|
| | Farm products excluding coffee | | Crops, excluding coffee | | Livestock and livestock products | | | |
| | Current | Deflated | Current | Deflated | Current | Deflated | Current | Deflated |
| 1950 | 45.8 | 98.1 | 49.3 | 106.3 | 43.1 | 91.3 | | |
| 1951 | 49.7 | 96.6 | 53.1 | 103.8 | 44.9 | 86.3 | | |
| 1952 | 49.3 | 94.3 | 46.8 | 90.1 | 52.2 | 98.9 | | |
| 1953 | 54.0 | 98.6 | 51.9 | 95.3 | 56.7 | 102.4 | | |
| 1954 | 61.7 | 101.2 | 61.5 | 101.5 | 63.0 | 102.2 | | |
| 1955 | 60.8 | 99.9 | 56.5 | 93.5 | 66.1 | 107.5 | | |
| 1956 | 63.7 | 97.0 | 62.5 | 95.8 | 65.2 | 98.2 | | |
| 1957 | 75.0 | 97.5 | 75.9 | 99.2 | 74.9 | 96.4 | | |
| 1958 | 85.0 | 97.4 | 83.3 | 96.1 | 87.3 | 99.1 | | |
| 1959 | 96.8 | 104.0 | 91.5 | 99.0 | 104.2 | 110.9 | | |
| 1960 | 102.9 | 101.9 | 93.2 | 92.9 | 115.7 | 113.5 | | |
| 1961 | 111.3 | 101.8 | 106.9 | 98.6 | 116.5 | 105.6 | | |
| 1962 | 115.0 | 98.6 | 108.8 | 94.0 | 119.0 | 101.1 | | |
| 1963 | 141.1 | 98.3 | 145.7 | 102.2 | 133.6 | 92.2 | | |
| 1964 | 178.1 | 106.6 | 198.3 | 119.6 | 157.1 | 93.2 | | |
| 1965 | 189.8 | 104.1 | 192.6 | 106.3 | 182.9 | 99.3 | | |
| 1966 | 219.7 | 104.9 | 221.5 | 106.4 | 217.6 | 102.8 | | |
| 1967 | | | | | 253.4 | 110.0 | | |
| 1968 (P) | | | | | 268.5 | | | |

(P) = Preliminary

Source: Derived from national accounts estimates, Banco de la República, Colombia.

Table 16.--Prices of major crops by groups, deflated basis, Colombia, 1950-67
(1950-66=100)

| Year | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 5A |
|------------|---------|---------|---------|---------|---------|----------|
| 1950 | 89 | 87 | 134 | 91 | 80 | 95 |
| 1951 | 103 | 91 | 111 | 85 | 89 | 96 |
| 1952 | 108 | 86 | 87 | 90 | 78 | 102 |
| 1953 | 108 | 87 | 99 | 91 | 87 | 93 |
| 1954 | 131 | 95 | 110 | 91 | 89 | 83 |
| 1955 | 114 | 99 | 93 | 87 | 87 | 94 |
| 1956 | 140 | 94 | 105 | 80 | 80 | 94 |
| 1957 | 133 | 107 | 100 | 85 | 93 | 108 |
| 1958 | 115 | 97 | 93 | 99 | 104 | 109 |
| 1959 | 86 | 97 | 87 | 115 | 124 | 105 |
| 1960 | 87 | 85 | 85 | 112 | 118 | 97 |
| 1961 | 85 | 96 | 105 | 107 | 116 | 96 |
| 1962 | 78 | 103 | 76 | 115 | 114 | 98 |
| 1963 | 79 | 115 | 105 | 107 | 105 | 106 |
| 1964 | 85 | 140 | 120 | 119 | 109 | 101 |
| 1965 | 79 | 115 | 90 | 118 | 115 | 112 |
| 1966 | 79 | 107 | 101 | 106 | 113 | 111 |
| 1967 | 75 | 106 | 89 | 104 | 107 | 91 |

Source: Calculated from app. in Changes in Agricultural Production and Technology in Colombia, U.S. Dept. Agr., Foreign Agr. Econ. Rpt. No. 52, 1969, based on price data from Banco de la República, weighted by production of the various crops within each group.

Table 17.--Production per capita of Colombia's major crop groups in 1958 prices, 1950-68

| Year | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Group 5A | |
|------------|---------|---------|---------|---------|---------|----------|----|
| 1950 | 104 | 63 | 43 | Pesos | 11 | 29 | 4 |
| 1951 | 91 | 65 | 58 | | 11 | 34 | 4 |
| 1952 | 118 | 64 | 61 | | 12 | 36 | 3 |
| 1953 | 110 | 63 | 55 | | 13 | 34 | 4 |
| 1954 | 112 | 62 | 55 | | 13 | 41 | 4 |
| 1955 | 102 | 61 | 52 | | 13 | 41 | 4 |
| 1956 | 88 | 57 | 52 | | 13 | 41 | 4 |
| 1957 | 93 | 55 | 50 | | 12 | 38 | 4 |
| 1958 | 116 | 51 | 50 | | 12 | 42 | 6 |
| 1959 | 111 | 53 | 55 | | 13 | 56 | 6 |
| 1960 | 112 | 50 | 49 | | 13 | 58 | 7 |
| 1961 | 101 | 55 | 42 | | 13 | 62 | 7 |
| 1962 | 105 | 53 | 50 | | 12 | 69 | 7 |
| 1963 | 95 | 50 | 40 | | 12 | 61 | 9 |
| 1964 | 96 | 46 | 48 | | 12 | 62 | 10 |
| 1965 | 97 | 45 | 44 | | 13 | 65 | 11 |
| 1966 | 87 | 47 | 43 | | 13 | 70 | 11 |
| 1967 | 88 | 48 | 40 | | 13 | 73 | 11 |
| 1968 | 82 | 48 | 43 | | 13 | 81 | 8 |

Source: Calculated from app. in Changes in Agricultural Production and Technology in Colombia, U.S. Dept. Agr., Foreign Agr. Econ. Rpt. No. 52, 1969.

Table 18.--Major crops: Group 1--coffee--prices, production, area, and real income per hectare, Colombia, 1950-68

| Year | Index, 1950-66=100 | | In 1958 prices | | Area 1,000 hectares |
|---------------|----------------------------|-------|----------------------------|------------------------|------------------------|
| | Average price, deflated | | Real income per hectare | Value of production | |
| | (1) | (2) | (3) | (4) | |
| 1950..... | 89 | 1,421 | 1,206.4 | 656.0 | |
| 1951..... | 103 | 1,455 | 1,079.4 | 660.0 | |
| 1952..... | 108 | 1,994 | 1,437.9 | 675.0 | |
| 1953..... | 108 | 1,545 | 1,372.3 | 831.0 | |
| 1954..... | 131 | 1,874 | 1,439.5 | 872.5 | |
| 1955..... | 114 | 1,636 | 1,346.7 | 816.2 | |
| 1956..... | 140 | 2,006 | 1,196.6 | 725.3 | |
| 1957..... | 133 | 1,900 | 1,304.0 | 790.4 | |
| 1958..... | 115 | 2,010 | 1,673.2 | 832.5 | |
| 1959..... | 86 | 1,441 | 1,649.8 | 858.7 | |
| 1960..... | 87 | 1,456 | 1,714.1 | 892.5 | |
| 1961..... | 85 | 1,427 | 1,607.0 | 831.5 | |
| 1962..... | 78 | 1,420 | 1,721.6 | 824.1 | |
| 1963..... | 79 | 1,353 | 1,607.0 | 810.0 | |
| 1964..... | 85 | 1,515 | 1,671.2 | 813.1 | |
| 1965..... | 79 | 1,479 | 1,756.9 | 812.0 | |
| 1966..... | 79 | 1,377 | 1,628.4 | 811.4 | |
| 1967..... | 75 | 1,370 | 1,703.4 | 810.6 | |
| 1968 (P)..... | | | 1,628.4 | 816.3 | |

(P) = Preliminary

Source: Column (1), see table 8. Column (2), calculations based on physical production, deflated prices, and area from app. in Changes in Agricultural Production and Technology in Colombia, U.S. Dept. Agr., Foreign Agr. Econ. Rpt. No. 52, 1969. Columns (3) and (4) taken directly from the same source.

Table 19.--Major crops: Group 2--yuca, beans, plantains, and brown sugar--prices, production, area, and real income per hectare, Colombia, 1950-68

| Year | Index, 1950-66=100 | | In 1958 prices | | Area 1,000 hectares |
|---------------|----------------------------|-------|----------------------------|------------------------|------------------------|
| | Average price, deflated | | Real income per hectare | Value of production | |
| | (1) | (2) | (3) | (4) | |
| 1950..... | 87 | 1,197 | 731.5 | 553.9 | |
| 1951..... | 91 | 1,241 | 774.7 | 580.0 | |
| 1952..... | 86 | 1,151 | 774.0 | 590.3 | |
| 1953..... | 87 | 1,211 | 780.8 | 573.9 | |
| 1954..... | 95 | 1,209 | 739.3 | 639.2 | |
| 1955..... | 99 | 1,201 | 799.8 | 642.5 | |
| 1956..... | 94 | 1,130 | 767.9 | 652.4 | |
| 1957..... | 107 | 1,249 | 771.1 | 660.3 | |
| 1958..... | 97 | 1,147 | 741.3 | 646.1 | |
| 1959..... | 97 | 1,266 | 786.0 | 625.9 | |
| 1960..... | 85 | 1,113 | 767.1 | 618.5 | |
| 1961..... | 96 | 1,370 | 873.9 | 615.5 | |
| 1962..... | 103 | 1,440 | 871.7 | 642.3 | |
| 1963..... | 115 | 1,553 | 849.3 | 660.8 | |
| 1964..... | 140 | 1,834 | 799.9 | 651.5 | |
| 1965..... | 115 | 1,616 | 815.9 | 634.2 | |
| 1966..... | 107 | 1,504 | 870.8 | 666.2 | |
| 1967..... | 106 | 1,583 | 930.5 | 676.7 | |
| 1968 (P)..... | | | 995.6 | 693.1 | |

(P) = Preliminary. For sources of data, see table 18.

Table 20.--Major crops: Group 3--corn, potatoes, wheat, and tobacco--prices, production, area, and real income per hectare, Colombia, 1950-68

| Year | Index, 1950-66=100 : | | In 1958 prices | | Area (4) |
|---------------|----------------------|-------------|----------------|---------|----------------|
| | Average price, | Real income | Value of | | |
| | deflated | per hectare | production | | |
| | (1) | (2) | (3) | | (4) |
| | | Pesos | Million pesos | | 1,000 hectares |
| 1950..... | 134 | 852 | 498.9 | 854.8 | |
| 1951..... | 111 | 830 | 683.1 | 1,018.2 | |
| 1952..... | 87 | 652 | 740.5 | 1,113.0 | |
| 1953..... | 99 | 791 | 691.3 | 951.0 | |
| 1954..... | 110 | 887 | 703.6 | 956.0 | |
| 1955..... | 93 | 630 | 679.6 | 1,086.0 | |
| 1956..... | 105 | 744 | 709.1 | 1,074.3 | |
| 1957..... | 100 | 863 | 695.6 | 884.8 | |
| 1958..... | 93 | 783 | 719.6 | 918.4 | |
| 1959..... | 87 | 809 | 819.0 | 971.3 | |
| 1960..... | 85 | 740 | 745.0 | 957.8 | |
| 1961..... | 105 | 818 | 671.4 | 932.9 | |
| 1962..... | 76 | 730 | 825.1 | 940.9 | |
| 1963..... | 105 | 866 | 669.1 | 892.6 | |
| 1964..... | 120 | 1,201 | 844.8 | 969.1 | |
| 1965..... | 90 | 729 | 788.1 | 1,080.8 | |
| 1966..... | 101 | 847 | 799.9 | 1,049.8 | |
| 1967..... | 89 | 814 | 772.3 | 960.0 | |
| 1968 (P)..... | | | 845.6 | 975.0 | |

(P) = Preliminary. For sources of data, see table 18.

Table 21.--Major crops: Group 4--bananas and cocoa--prices, production, area, and real income per hectare, Colombia, 1950-68

| Year | Index, 1950-66=100 : | | In 1958 prices | | Area (4) |
|---------------|----------------------|-------------|----------------|------|----------------|
| | Average price, | Real income | Value of | | |
| | deflated | per hectare | production | | |
| | (1) | (2) | (3) | | (4) |
| | | Pesos | Million pesos | | 1,000 hectares |
| 1950..... | 91 | 1,639 | 127.0 | 71.7 | |
| 1951..... | 85 | 1,509 | 130.5 | 75.7 | |
| 1952..... | 90 | 1,636 | 144.3 | 76.0 | |
| 1953..... | 91 | 1,827 | 157.4 | 77.4 | |
| 1954..... | 91 | 1,881 | 161.6 | 77.9 | |
| 1955..... | 87 | 1,876 | 167.5 | 79.3 | |
| 1956..... | 80 | 1,818 | 174.7 | 78.3 | |
| 1957..... | 85 | 1,876 | 173.5 | 79.0 | |
| 1958..... | 99 | 2,123 | 174.1 | 82.0 | |
| 1959..... | 115 | 2,730 | 186.3 | 80.0 | |
| 1960..... | 112 | 2,640 | 193.3 | 82.0 | |
| 1961..... | 107 | 2,526 | 200.1 | 84.0 | |
| 1962..... | 115 | 2,483 | 189.8 | 83.0 | |
| 1963..... | 107 | 2,363 | 208.0 | 91.0 | |
| 1964..... | 119 | 2,439 | 205.5 | 95.0 | |
| 1965..... | 118 | 2,803 | 231.6 | 95.4 | |
| 1966..... | 106 | 2,756 | 251.5 | 96.0 | |
| 1967..... | 104 | 2,867 | 259.1 | 95.0 | |
| 1968 (P)..... | | | 264.5 | 97.2 | |

(P) = Preliminary. For sources of data, see table 18.

Table 22.--Major crops: Group 5--cotton, rice and sugar--prices, production, area, and real income per hectare, Colombia, 1950-68

| Year | Index, 1950-66=100 | | In 1958 prices | | Area 1,000 hectares |
|---------------|----------------------------|----------------------------|------------------------|-------|------------------------|
| | Average price, deflated | Real income per hectare | Value of production | : | |
| | (1) | (2) | (3) | (4) | |
| | | Pesos | Million pesos | | |
| 1950..... | 80 | 1,010 | 336.2 | 215.2 | |
| 1951..... | 89 | 1,251 | 400.2 | 235.3 | |
| 1952..... | 78 | 1,080 | 442.0 | 256.2 | |
| 1953..... | 87 | 1,057 | 424.9 | 269.6 | |
| 1954..... | 89 | 1,143 | 530.9 | 308.8 | |
| 1955..... | 87 | 1,102 | 544.4 | 325.2 | |
| 1956..... | 80 | 1,108 | 556.8 | 311.7 | |
| 1957..... | 93 | 1,253 | 533.2 | 306.1 | |
| 1958..... | 104 | 1,448 | 602.8 | 330.5 | |
| 1959..... | 124 | 1,789 | 832.5 | 391.9 | |
| 1960..... | 118 | 1,661 | 896.1 | 440.5 | |
| 1961..... | 116 | 1,736 | 984.2 | 449.9 | |
| 1962..... | 114 | 1,737 | 1,124.1 | 513.6 | |
| 1963..... | 105 | 1,642 | 1,027.5 | 460.1 | |
| 1964..... | 109 | 1,615 | 1,078.0 | 524.2 | |
| 1965..... | 115 | 1,646 | 1,172.6 | 603.3 | |
| 1966..... | 113 | 1,728 | 1,311.7 | 605.6 | |
| 1967..... | 107 | 1,913 | 1,414.4 | 554.8 | |
| 1968 (P)..... | | | 1,651.9 | 569.6 | |

(P) = Preliminary. For sources of data, see table 18.

Table 23.--Major crops: Group 5A--sesame, barley, soybeans, and grain sorghum--prices, production, area, and real income per hectare, Colombia, 1950-68

| Year | Index, 1950-66=100 | | In 1958 prices | | Area 1,000 hectares |
|---------------|----------------------------|----------------------------|------------------------|-------|------------------------|
| | Average price, deflated | Real income per hectare | Value of production | : | |
| | (1) | (2) | (3) | (4) | |
| | | Pesos | Million pesos | | |
| 1950..... | 95 | 689 | 43.2 | 57.9 | |
| 1951..... | 96 | 698 | 43.0 | 61.0 | |
| 1952..... | 102 | 688 | 42.3 | 68.0 | |
| 1953..... | 93 | 681 | 53.3 | 79.9 | |
| 1954..... | 83 | 606 | 50.1 | 68.8 | |
| 1955..... | 94 | 669 | 48.4 | 61.0 | |
| 1956..... | 94 | 760 | 60.9 | 70.7 | |
| 1957..... | 108 | 885 | 58.6 | 66.9 | |
| 1958..... | 109 | 872 | 79.5 | 91.2 | |
| 1959..... | 105 | 949 | 94.3 | 101.5 | |
| 1960..... | 97 | 988 | 104.1 | 98.6 | |
| 1961..... | 96 | 963 | 103.8 | 96.8 | |
| 1962..... | 98 | 968 | 111.9 | 110.7 | |
| 1963..... | 106 | 1,050 | 147.5 | 136.9 | |
| 1964..... | 101 | 1,006 | 178.7 | 176.8 | |
| 1965..... | 112 | 1,092 | 198.3 | 190.8 | |
| 1966..... | 111 | 985 | 197.7 | 205.0 | |
| 1967..... | 91 | 930 | 203.1 | 203.0 | |
| 1968 (P)..... | | | 168.7 | 156.8 | |

(P) = Preliminary. For sources of data, see table 18.

Table 24.--Prices of fertilizer and crops, deflated basis, Colombia, 1950-66

| Year | (1950-66=100) | | | Fertilizer Crops 1/ Crops 1/ | Ratio of prices: Fertilizer Crops |
|-------|---------------|---------------------------|----------------------|------------------------------------|---|
| | 1950-66=100) | Fertilizer 1/ Crops 1/ | Crops 1/ Crops 1/ | | |
| 1950. | 91.1 | 98.7 | 98.7 | 83.1 | |
| 1951. | 86.2 | 103.2 | 103.2 | 75.1 | |
| 1952. | 105.2 | 97.4 | 97.4 | 97.1 | |
| 1953. | 82.7 | 100.3 | 100.3 | 74.2 | |
| 1954. | 64.3 | 113.5 | 113.5 | 50.9 | |
| 1955. | 73.6 | 101.7 | 101.7 | 65.0 | |
| 1956. | 73.0 | 113.4 | 113.4 | 57.8 | |
| 1957. | 70.7 | 113.5 | 113.5 | 56.0 | |
| 1958. | 108.8 | 102.9 | 102.9 | 95.1 | |
| 1959. | 112.1 | 93.4 | 93.4 | 108.0 | |
| 1960. | 103.0 | 91.2 | 91.2 | 101.7 | |
| 1961. | 96.0 | 92.6 | 92.6 | 93.2 | |
| 1962. | 91.4 | 88.2 | 88.2 | 93.4 | |
| 1963. | 136.7 | 92.9 | 92.9 | 132.3 | |
| 1964. | 135.0 | 106.3 | 106.3 | 114.3 | |
| 1965. | 130.8 | 96.4 | 96.4 | 122.1 | |
| 1966. | 139.0 | 94.3 | 94.3 | 132.5 | |

1/ Deflated by implicit prices of GNP.

Source: Calculated from estimates of Revista del Banco de la República (issued monthly), Colombia.

CHAPTER IV -- NONTRADITIONAL INPUTS

This chapter summarizes Colombia's progress in using nontraditional inputs to increase agricultural output. Pesticides, fertilizers, improved seeds, and mechanization are treated in turn. Most of the data used are from recent analyses prepared by the Colombian Government as a preliminary step to reorient agricultural policy to increase output and productivity.

Clearly, it would be desirable to show how much these nontraditional inputs have contributed to production gains, along with increased traditional inputs of land and labor. But this has not been attempted here. A complementary study (not yet published) by Albert Berry of the Yale University Economic Growth Center has made such a functional analysis, exploiting fully the available data in both cross section and time series functions. However, new data will be required to improve on the inconclusive results of this study.

Pesticide Application

Estimates of the physical volume of pesticides used in Colombia during 1951-67 are based on imports, since no raw materials for pesticides were produced domestically during the period. Imports averaged somewhat above 10,000 tons annually during 1951-67, with no definite trend (table 25). Wide year-to-year fluctuations reflect variations in controls imposed by the availability of foreign exchange. The most notable shift in composition of imports was the substitution of other chemicals for copper sulfate. This substitution was virtually completed about 1959. Before 1959, copper sulfate had comprised a considerable portion of total imports of pesticides.

Table 25.--Colombia's imports of pesticides, 1951-67

| Year | Total | Excluding copper sulfate | |
|-----------|--------|--------------------------|--------|
| | | Metric tons | |
| 1951..... | 10,194 | | 2,250 |
| 1952..... | 12,379 | | 3,418 |
| 1953..... | 6,770 | | 2,525 |
| 1954..... | 12,095 | | 5,741 |
| 1955..... | 10,361 | | 5,616 |
| 1956..... | 13,789 | | 5,975 |
| 1957..... | 16,565 | | 8,475 |
| 1958..... | 9,459 | | 7,055 |
| 1959..... | 10,830 | | 10,819 |
| 1960..... | 12,594 | | 11,900 |
| 1961..... | 15,322 | | 15,217 |
| 1962..... | 10,792 | | 10,789 |
| 1963..... | 12,238 | | 12,187 |
| 1964..... | 14,697 | | 14,690 |
| 1965..... | 9,512 | | 9,512 |
| 1966..... | 17,054 | | 17,008 |
| 1967..... | 8,586 | | 8,583 |

Source: Instituto de Investigaciones Technológicas, Colombia.

Although all of the active ingredients for pesticides were imported, and only a small proportion were mixed within the country, the wholesale price of pesticides rose less than all wholesale prices during the past 10 or 15 years (table 26). Colombia's Technological Institute (IIT) has estimated that a cultivated area of nearly 1 million hectares has received application of pesticides in recent years. This area is about one-fourth of the total crop acreage, and considerably larger than the area fertilized.

Table 26.--Index of wholesale prices of pesticides in Colombia, 1951-66
(1958=100)

| Year | Chemical products | All products |
|-----------|-------------------|--------------|
| 1951..... | 53.0 | 56.1 |
| 1952..... | 53.1 | 55.5 |
| 1953..... | 53.2 | 58.8 |
| 1954..... | 52.4 | 62.8 |
| 1955..... | 54.5 | 63.8 |
| 1956..... | 60.3 | 68.6 |
| 1957..... | 77.5 | 85.2 |
| 1958..... | 100.0 | 100.0 |
| 1959..... | 107.3 | 109.6 |
| 1960..... | 109.6 | 114.2 |
| 1961..... | 112.5 | 121.7 |
| 1962..... | 115.8 | 124.9 |
| 1963..... | 143.3 | 151.7 |
| 1964..... | 154.2 | 185.3 |
| 1965..... | 166.7 | 200.6 |
| 1966..... | 200.4 | 235.5 |
| | | |

Source: Banco de la República, Colombia.

In recent years, herbicides have formed an important part of the value of total pesticide imports, their share varying from 30 percent to 45 percent. Most of the remaining imports have consisted of insecticides, with fungicides accounting for a small fraction of the total (table 27).

Table 27.--Relative value of Colombia's imports of pesticides by type, 1965-67

| Group | 1965 | 1966 | 1967 |
|--------------------------|-------|-------|-------|
| ----- Percent ----- | | | |
| I--Insecticides..... | 49.5 | 68.0 | 57.1 |
| II--Herbicides..... | 44.9 | 29.3 | 36.9 |
| III--Fungicides..... | 5.1 | 2.4 | 5.3 |
| IV--Other pesticides.... | 0.5 | 0.3 | 0.7 |
| Total..... | 100.0 | 100.0 | 100.0 |

Source: Instituto de Investigaciones Technológicas, Colombia.

Pesticides Use by Crops

Most insecticides and fungicides have been used on a relatively small number of crops produced for sale (table 28). In 1967, over three-fifths of insecticides were used for cotton, and one-fifth for rice. In the case of cotton, control of insects may represent one-third of the total cost of production of the crop. In addition to facing destructive tropical pests, Colombia has been infested with all the principal insects that cotton growers have had to contend with in subtropical and temperate climates. 9/ Fungicides are used

Table 28.--Consumption of pesticides (active ingredients) in Colombia,
by crops, 1967

| Crops | Insecticides | Fungicides | Herbicides | Total pesticides |
|----------------|--------------|------------|------------|------------------|
| Metric tons | | | | |
| Corn..... | 59 | -- | 91 | 150 |
| Potatoes..... | 18 | 1,424 | -- | 1,442 |
| Wheat..... | 54 | -- | 62 | 116 |
| Tobacco..... | 59 | 42 | -- | 101 |
| Bananas..... | -- | 3,580 | -- | 3,580 |
| Cotton..... | 2,536 | -- | 99 | 2,635 |
| Rice..... | 790 | 81 | 396 | 1,267 |
| Sugarcane..... | 12 | -- | 390 | 402 |
| Barley..... | 81 | -- | 55 | 136 |
| Others..... | 280 | 476 | 599 | 1,355 |
| Total..... | 3,889 | 5,603 | 1,692 | 11,184 |

Source: Instituto de Investigaciones Technológicas, Colombia.

principally on bananas for export and on potatoes. Potatoes and some vegetables -- especially tomatoes -- are of special interest since the spraying methods used for them can be adapted to the needs of very small growers. Sprayers mounted on mules and burros give acceptable control.

Herbicides are more widely used than the other pesticides among a larger number of crops. About half the total is used on rice and sugarcane.

It has not been feasible to evaluate the progress made in the use of pesticides in Colombia. The area of nearly a million hectares on which they are used is impressive, but it is difficult to judge whether or not the relatively constant quantity used from 1951 to date has represented improved control per unit of pesticides. The wholesale f.o.b. value of insecticides imported has been about 1 percent of the value of all crops produced in recent years. Despite the infeasibility of evaluating the effects of pesticides on output in Colombia, it is apparent that: (1) potatoes, tobacco, and tomatoes grown for sale require both pesticides and fertilizer, and small farmers or sharecroppers use both these inputs; and (2) cotton, irrigated rice, and sugarcane for sugar require pesticides. Cotton and sugarcane are often grown without fertilizer, and irrigated rice is sometimes so grown.

Fertilizer

Although aims, policies, and accomplishments of the fertilizer industry in Colombia are quite complex, the general situation on fertilizer inputs for

9/ For an account of the struggle with cotton pests, see (25).

agricultural production is relatively clear. It is a picture of irregular but substantial growth during the period since World War II.

Consumption was still negligible in the early postwar years through 1950. It then grew rapidly in the early 1950's as foreign exchange was in good supply, and again expanded in the early 1960's as the domestic fertilizer industry was getting established. This irregular pattern of growth with strong upsurges and intervening lulls, is shown clearly in fig. 25 and table 29. Throughout 1950-67, the annual rate of growth averaged 6 percent for total fertilizer, and a little more than 5 percent for total nutrients (the average nutrient content has declined in recent years). Fertilizer consumption remains low in comparison with use in developed countries and some developing countries that are making good progress in agriculture. Consumption ranged between 100,000 and 125,000 tons of nutrients per year during 1964-68. If about 5 million hectares of land were cultivated (including 1 million hectares fallow), this consumption figure represents 20 to 25 kilograms per hectare (18 to 22 pounds per acre), an amount moderately higher than the average for Latin America, but about half the average for developed countries (21, pp. 127-128). Fertilizer is used on 15 percent of the land in cultivation (12, p. 11).

Fertilizer Use by Crops

With less than 2 percent of total acreage in cultivation, potatoes account for a third of all fertilizer application. Potatoes are the one crop in Colombia for which fertilizer is almost always used, and as much is used as has been recommended by a committee of specialists (table 30). Fertilization is common for irrigated rice, and among minor crops, bananas for export and tomatoes and some vegetables grown for urban markets. Fertilizer use is also important for wheat, where three-fifths of the area receives an application. Smaller proportions of the area of tobacco, cotton, sugarcane, barley, and coffee account for most of the rest of fertilizer used. On the whole array of other crops and pasture, little inorganic fertilizer is used. Organic fertilizer is of some importance for coffee. The manure from the fairly large number of animals is of limited value, as a consequence of the low level of feeding.

One of the characteristics of fertilizer usage is that it is limited to specific crops produced for sale. Practical problems (such as financing) prevent fertilizer usage on subsistence crops. Lack of research results and specific input recommendations add to the uncertainty of obtaining profitable returns. Fertilizer application to seeded pasture has been reported as highly profitable (table 33), but it is insignificant in Colombia.

Fertilizer Industry

For several years, a large part of the fertilizer consumed in Colombia has been supplied by domestic fertilizer plants. Volume production was first attained in 1963, when most of the fertilizer requirements were met by the domestic industry's production of 150,000 tons. Production expanded rapidly in 1964, to 270,000 tons. Since then, production has shown only small changes, declining a little in 1965 and rising somewhat in subsequent years. As shown in table 31, fertilizer production in 1966 and 1967 utilized less than two-fifths of installed capacity. One large private company produced half of domestic production and managed to operate at 60 percent of installed capacity

Table 29.--Fertilizer available for consumption in Colombia, 1950-68

| Year | Total available | | |
|-----------|--------------------|--------------------------|--|
| | Physical volume | Nutrients (N + P + K) | Nutrients as a percentage of physical volume |
| | Metric tons | Metric tons | Percent |
| 1950..... | 16,137 | 6,128 | 38.00 |
| 1951..... | 52,537 | 23,277 | 44.30 |
| 1952..... | 34,383 | 14,887 | 43.30 |
| 1953..... | 40,304 | 18,411 | 45.68 |
| : | | | |
| 1954..... | 76,878 | 38,332 | 49.86 |
| 1955..... | 106,902 | 52,059 | 48.70 |
| 1956..... | 100,216 | 49,976 | 49.87 |
| 1957..... | 132,496 | 62,023 | 46.81 |
| : | | | |
| 1958..... | 127,070 | 60,219 | 47.39 |
| 1959..... | 78,669 | 39,647 | 50.40 |
| 1960..... | 119,288 | 54,487 | 45.68 |
| 1961..... | 166,164 | 74,297 | 44.71 |
| : | | | |
| 1962..... | 169,509 | 82,198 | 48.49 |
| 1963..... | 151,000 | 48,000 | 31.79 |
| 1964..... | 268,000 | 97,000 | 36.19 |
| 1965..... | 236,000 | 92,000 | 38.98 |
| : | | | |
| 1966..... | 298,000 | 116,000 | 38.93 |
| 1967..... | 311,000 | 119,000 | 38.26 |
| 1968..... | 309,000 | 122,000 | 39.48 |
| : | | | |

Source: 1950-62: Instituto de Investigaciones Technológicos, Colombia,
 "Estudio Sobre el Mercado de Fertilizantes en Colombia, 1966." 1963-68:
 Ministerio de Agricultura, Colombia.

Table 30.--Area fertilized, 1966 and nutrients used per hectare, 1967, for selected crops in Colombia

| Crop | Area fertilized, 1966 | | Nutrients per hectare, 1967 | |
|------------------------------------|-----------------------|--------------|-----------------------------|---------------------|
| | : Percentage of : | | : Deficiency in | |
| | Total | : total area | Total | : relation to |
| | | : cultivated | | : recommended usage |
| | <u>1,000 ha.</u> | <u>Pct.</u> | <u>Kg./ha.</u> | <u>Pct.</u> |
| Coffee..... | 97 | 12 | 49 | 65 |
| Yuca..... | 2 | 1 | 53 | 1/ |
| Beans..... | 5 | 7 | 42 | 86 |
| Plantains..... | 3 | 1 | 53 | 1/ |
| Noncentrifugal sugar (panela)..... | 23 | 10 | 130 | 19 |
| Corn..... | 12 | 2 | 35 | 60 |
| Potatoes..... | 79 | 100 | 414 | 8 |
| Wheat..... | 42 | 62 | 220 | 0 |
| Tobacco..... | 6 | 26 | 165 | 29 |
| Bananas..... | 19 | 33 | 140 | 30 |
| Cocoa..... | 4 | 11 | 1/ | 1/ |
| Cotton..... | 49 | 28 | 140 | 0 |
| Rice..... | 82 | 28 | 154 | 27 |
| Sugarcane for sugar... | 16 | 18 | 130 | 19 |
| Sesame..... | 9 | 17 | 1/ | 1/ |
| Barley..... | 12 | 20 | 81 | 63 |
| Soybeans..... | 8 | 16 | 56 | 81 |
| Grain sorghum..... | 5 | 12 | 53 | 85 |

1/ No recommendation or information available.

Source: The first 2 columns are estimates for 1966 based on data in El Uso de Fertilizantes en Colombia, Food and Agr. Org./CEPAL. The last 2 columns are estimates for 1967 based upon the same source.

Table 31.--Fertilizer industry mixing capacity, production, and rate of utilization, Colombia, 1966 and 1967

| Producer | Installed capacity | | Production | Rate of utilization | |
|----------------------|--------------------------|-----|----------------|---------------------|----|
| | : for mixed | | : of mixed | : of capacity | |
| | : fertilizers and urea | | : fertilizer | : | |
| | | | 1966 : 1967 | 1966 : 1967 | |
| | <u>1,000 metric tons</u> | | <u>Percent</u> | | |
| Abocol..... | 200 | 120 | 146 | 60 | 73 |
| Caja Agraria..... | 300 | 50 | 60 | 17 | 20 |
| Sulfacidos S.A..... | 100 | 36 | 34 | 36 | 34 |
| Quin S.A..... | 25 | 4 | 5 | 16 | 20 |
| Ferticol (urea only) | 15 | -- | -- | -- | -- |
| Others..... | 60 | 30 | 28 | 50 | 47 |
| Total..... | 700 | 240 | 273 | 35 | 39 |

Source: Departamento Nacional de Planeación, Colombia, "Informe sobre la Producción y Consumo de Fertilizantes en Colombia," p. 10, Dec. 18, 1968.

in 1966 and 73 percent in 1967. None of the other producers exceeded a 50-percent operating rate. The Government's Agricultural Development Bank (Caja Agraria), with almost half of the country's total installed capacity, operated at only one-fifth of capacity, producing mainly a low-nitrate formula (5-20-12) suitable principally for potatoes. A large fertilizer plant (FERTICOL, in Barrancabermeja) in which the Bank is the principal stockholder has been a very complex venture, financed in part by international credit, and built by an Italian group several years ago. This large plant has produced rather small quantities of fertilizer on a stop-and-go schedule. It has never achieved the economies of scale for which it was originally designed. At present, its use or disposition poses a difficult problem which has been much studied but not completely resolved. Production was resumed in 1969 on a fairly regular schedule.

Newer and much cheaper technology has developed throughout the world in recent years. Plants designed with new technology are under construction by private firms. Although many influences other than fertilizer prices rising faster than crop prices have contributed to the slower rise in fertilizer sales and usage in recent years, increased quantities of fertilizer from new plants may make possible price reductions which will increase sales. The elasticity of demand for fertilizer has been estimated to be around unity (that is, -1.0), implying that a reduction in price of 10 percent would be accompanied by increased tonnage sales of about 10 percent (12, p. 30).

In recent years, except 1966, fertilizer production from domestic materials has been around 200,000 tons (table 32). These fertilizers, with a low nutrient content (principally nitrogen) of around 20 percent, are mixed with imported fertilizers averaging around 50 percent nutrient content, producing an average for all domestic fertilizers from 30 to nearly 40 percent.

The problem of quality of domestically produced fertilizers has not been completely resolved. In recent years, about 30 percent of Colombia's fertilizer has been produced by mechanical mixers. A recent evaluation by the Ministry of Agriculture classified some companies producing with mechanical mixers as operating with a certain grade of technique, and operations of other companies were classified as without technique (*sin técnica*). Fertilizers produced by the latter class of companies are inferior to those produced by chemical reaction, principally because of a lack of homogeneity of the product. The Colombian National Department of Planning has observed that the quality problem does not have much significance since the mechanically mixed fertilizers compete in prices with those produced by chemical reaction (12, p. 19). On the other hand, complaints about quality have been widely reported as a reason for limited use of fertilizer. Inspection and control have not been available at the retail level. For some farmers, the considerable reduction in the nutrient content of fertilizer since domestic production began may seem to mean a deterioration of the product. In particular, those who do not read or interpret the labels would probably have this reaction upon harvesting, since they would not have realized that the nutrient concentration had been reduced.

One approach to understanding the restricted use of fertilizer in Colombia is to analyze the profitability of such usage. The information

Table 32.--Imported and domestically produced raw materials used in domestic fertilizer production in Colombia, 1963-67

| Year | Imported raw materials | | | Domestic raw materials | | |
|----------|------------------------|-------------------------|--|------------------------|-------------------------|--|
| | Physical volume | Nutrients : (N + P + K) | Nutrients as a percentage of physical volume | Physical volume | Nutrients : (N + P + K) | Nutrients as a percentage of physical volume |
| | --- Metric tons --- | Percent | --- | Metric tons | --- | Percent |
| 1963...: | 116,490 | 59,235 | 50.85 | 91,278 | 19,785 | 21.67 |
| : | : | : | : | : | : | : |
| 1964...: | 129,848 | 67,331 | 51.85 | 210,284 | 41,736 | 19.85 |
| : | : | : | : | : | : | : |
| 1965...: | 91,642 | 48,866 | 53.32 | 199,137 | 40,592 | 20.38 |
| : | : | : | : | : | : | : |
| 1966...: | 168,075 | 88,089 | 52.41 | 123,641 | 24,132 | 19.52 |
| : | : | : | : | : | : | : |
| 1967...: | 139,223 | 73,086 | 52.49 | 185,837 | 42,901 | 23.09 |
| : | : | : | : | : | : | : |

Source: Ministerio de Agricultura, Colombia, Oficina de Planeamiento, Coordinación y Evaluación de Proyectos, 1968.

Table 33.--Profitability of the use of fertilizer for selected crops in Colombia, 1964

| Crop | Yield of check plot without fertilizer | Yield with fertilizer | Value of increased yield | Cost of fertilizer | Returns over cost of fertilizer |
|---------------------|--|-----------------------|--------------------------|--------------------|---------------------------------|
| | ----- Metric tons ----- | ----- | ----- Pesos ----- | ----- | ----- |
| | 15.0 | 25.0 | 2,400 | 731 | 1,669 |
| Potatoes.....: | 1.0 | 2.0 | 830 | 402 | 428 |
| Wheat.....: | 1.6 | 2.5 | 792 | 402 | 390 |
| Corn.....: | 1.0 | 3.0 | 1,180 | 402 | 778 |
| Irrigated rice....: | 2.2 | 3.7 | 1,097 | 252 | 845 |
| Alfalfa.....: | 7.0 | 17.5 | 7,350 | 845 | 6,505 |
| Seeded pasture....: | 6.0 | 18.0 | 4,200 | 497 | 3,703 |
| : | : | : | : | : | : |

Source: Food and Agr. Org./CEPAL, El Uso de Fertilizantes en Colombia, 1964.

available for such a comparison was quite limited 10/, but consistent with the uneven pattern of fertilizer usage in Colombia (table 33). For example, on potatoes, \$3.50 was earned for each dollar of fertilizer cost. Fertilizer returns from irrigated rice were more than \$4 for each \$1. On the other hand, returns from fertilizer usage on wheat and barley were only about \$2 for each \$1 spent, a ratio which is widely regarded as about the marginal return required to stimulate fertilizer application. Unusually large returns from the experimental application to seeded pasture remain a curiosity, since such application has rarely been tried in Colombia. 11/ Since these trials were conducted (see table 33), fertilizer prices have risen appreciably more than crop prices.

A Colombian Government Commission (including representatives of private firms) coordinated by Tomás López of the Ministry of Agriculture completed a study of fertilizer use in 1968 (12). Referring to the low level of fertilizer consumption, the committee developed a program to increase consumption. The short-term program of action was to provide credit and technical assistance, with the requirement that loans be used for fertilizer.

For the longer term, emphasis was placed on motivating technical assistance personnel, stepping up extension and teaching activities at various levels and through communication media, and increasing demonstrations and trials to form more precise recommendations and to motivate farmers. More use was recommended of minimum applications recommended by the National Experiment Station (ICA). A study was to be made of the possibilities of establishing a fund for experimental trials and campaigns for fertilizer usage. Better quality control was urged in the mixing of fertilizers and in inspection at the level of the distributor, since the farmer frequently pays high prices per unit of nutrient for mixed fertilizers. Stress was laid upon general effort and cooperation to achieve results. If the minimum recommendations of the national experiment station were met for all the land receiving some application, fertilizer consumption would triple.

The problems of obtaining a massive increase in fertilizer usage in Colombia are quite formidable. Only potatoes and irrigated rice have been fertilized regularly and adequately. Several other crops have been regularly fertilized, but less adequately than recommended, while others have received little if any fertilizer. Transportation of the fertilizer on a timely basis is a bottleneck in some areas. A shortage of research results, too little technical assistance, farmers' lack of knowledge of the benefits of fertilizer and the way to apply it, and problems of financing are all obstacles to be overcome. Nevertheless, Colombia has made a good start and has developed a fertilizer industry of sizable capacity with additional modern plants now being constructed. The Government has surveyed the problems confronting expanded usage and seems intent to take steps to overcome the limiting difficulties.

10/ This was recognized at the outset of the project, and a substantial effort to develop more adequate data was not very productive. The results shown in table 33 are getting a little old, and may not represent present relationships.

11/ A few owners of purebred herds and an occasional dairy near 1 of the principal cities have fertilized pastures.

The Colombian Government has long been concerned with improved seed production and use. Volume production of improved seeds began in 1953 when the National Agricultural Bank (Caja Agraria) began a program of selection, multiplication, and distribution which has been continued with participation by private enterprises (table 34).

Distinguished research to develop domestic varieties was done by the National Experiment Station, including several scientists of the Rockefeller Foundation. However, scientific work is only part of the complex undertaking of adoption of improved seeds in Colombia. The sometimes limited use of such seeds should not be interpreted as a criticism of the quality of the basic research.

By 1967, a total of 610,000 hectares of land devoted to 11 crops were planted with improved seed. This area represented a little over one-third of the total area of the 11 crops and about one-sixth of the total area for all crops cultivated in the country (tables 35 and 36).

All of the tobacco and cotton, and 60 to nearly 100 percent of the barley, soybeans, and grain sorghum area was planted with improved seed from 1963 through 1967. All of these crops except tobacco are grown with relatively modern technology. Yields have been well above average for developing countries, and production of each crop has increased strongly during the past two decades.

Improved seeds of barley and tobacco were developed within the country, whereas the other crops were grown from seeds imported from abroad and multiplied within the country (table 37).

Improved seeds were also important for rice and wheat. In 1963, one-fourth of the area in irrigated rice was planted with improved seed. By 1967, over half was. All of the improved seed was from imported varieties and was multiplied in the country. No improved seed was distributed for unirrigated rice. Improved wheat varieties were developed rather early. By 1959, nearly one-fifth of the area planted was planted with improved seed, with the proportion showing little change for several years thereafter. It began to rise in 1965, reaching more than half of the reduced acreage seeded in 1967.

The remaining four products for which improved seeds were distributed in 1953-67 reached lower rates of adoption. For corn, the proportion planted with improved seed varied from 10 to 15 percent of the total for a number of years (1962-66) before expanding to 23 percent in 1967. Improved beans exceeded 10 percent for the first time in 1967. Improved cocoa beans and potatoes were not widely distributed. An intensive effort to develop improved varieties of potatoes was sustained over a long period, but it encountered numerous and intractable problems of diseases, pests, and fungi, as well as consumer resistance to the taste of new varieties.

12/ This section is based upon a new analysis by Colombia's National Department of Planning (13).

Table 34.--Distribution of improved seeds in Colombia, by crop, 1953-67

| Year | Wheat | Corn | Beans | Irrigated rice | Barley | Cocoa | Soybeans | Grain sorghum | Cotton | Tobacco | Potatoes |
|-------------------------------|---------|---------|-------|----------------|---------|---------|----------|---------------|---------|---------|----------|
| ----- 1,000 metric tons ----- | | | | | | | | | | | |
| 1953 | 147.0 | 65.0 | | | | | | | | | |
| 1954 | 1,039.0 | 161.0 | | | | | | | | | |
| 1955 | 113.0 | 370.0 | | | | | | | | | |
| 1956 | 639.0 | 595.0 | 3.5 | | | | | | | | |
| 1957 | 599.0 | 744.0 | 21.5 | | | | | | | | |
| 1958 | 1,610.0 | 531.0 | -- | | | | | | | | |
| 1959 | 3,050.0 | 685.0 | 17.6 | | | | | | | | 910.0 |
| 1960 | 2,149.0 | 766.0 | 67.1 | | 3,751.0 | 2,120.0 | 950.0 | | | | 173.0 |
| 1961 | 2,830.0 | 1,023.0 | 38.4 | 400.0 | 3,223.1 | 500.0 | 1,260.0 | | | | 68.0 |
| 1962 | 2,470.0 | 1,230.0 | 106.0 | 3,551.0 | 2,848.1 | 500.0 | 1,540.0 | | | | 36.0 |
| 1963 | 2,100.0 | 1,147.0 | 161.0 | 4,348.0 | 3,871.2 | 300.0 | 1,720.0 | 120.0 | 4,597.9 | .130 | |
| 1964 | 1,868.0 | 1,881.0 | 103.0 | 7,179.0 | 3,096.0 | 1,097.2 | 2,300.0 | 609.0 | 4,915.3 | .230 | |
| 1965 | 2,784.0 | 2,087.0 | 463.0 | 9,904.0 | 2,737.0 | 758.4 | 2,780.0 | 461.1 | 4,429.0 | .225 | |
| 1966 | 3,114.0 | 2,164.0 | 309.0 | 9,300.0 | 3,495.0 | 988.7 | 3,270.0 | 308.8 | 5,654.7 | .250 | |
| 1967 | 3,677.0 | 3,062.0 | 548.0 | 9,890.0 | 3,300.0 | 1,345.0 | 3,120.0 | 501.6 | 5,423.8 | .330 | 244.9 |
| 1968 | | | | | | | | | | | |

Source: Eduardo Restrepo, "Semillas Mejoradas," Departamento Nacional de Planeación, 1968.

Table 35.--Areas planted to improved seeds in Colombia, by crop, 1953-67

| Year | Wheat | Corn | Beans | Irrigated rice | Barley | Cocoa | Soybeans | Grain sorghum | Cotton | Tobacco | Potatoes |
|----------------------------|-------|-------|-------|----------------|--------|-------|----------|---------------|--------|---------|----------|
| ----- 1,000 hectares ----- | | | | | | | | | | | |
| 1953 | 1.2 | 3.8 | | | | | | | | | |
| 1954 | 8.7 | 9.5 | | | | | | | | | |
| 1955 | 0.9 | 21.8 | | | | | | | | | |
| 1956 | 5.3 | 35.0 | 0.1 | | | | | | | | |
| 1957 | 4.9 | 43.8 | 0.3 | | | | | | | | |
| 1958 | 13.4 | 31.2 | | | | | | | | | |
| 1959 | 25.4 | 40.3 | 0.3 | | | | | | | | 1.2 |
| 1960 | 17.9 | 45.1 | 1.0 | | 50.0 | 3.0 | 12.7 | | | | 0.2 |
| 1961 | 23.6 | 46.2 | 0.6 | 2.7 | 42.9 | 0.7 | 16.8 | | | | 0.1 |
| 1962 | 20.6 | 72.4 | 1.6 | 23.7 | 37.9 | 0.7 | 20.5 | | | | 0.1 |
| 1963 | 17.5 | 67.5 | 2.5 | 28.9 | 51.6 | 0.4 | 22.9 | 8.0 | 139.3 | 37.1 | 0 |
| 1964 | 15.6 | 110.6 | 1.6 | 47.9 | 41.3 | 1.6 | 30.7 | 40.6 | 148.9 | 65.7 | 0 |
| 1965 | 23.2 | 122.8 | 7.1 | 66.0 | 36.5 | 1.1 | 37.1 | 30.7 | 134.2 | 64.3 | 0 |
| 1966 | 25.9 | 127.3 | 4.8 | 62.0 | 46.6 | 1.4 | 43.6 | 20.6 | 171.4 | 71.4 | 0 |
| 1967 | 30.6 | 180.1 | 8.4 | 65.9 | 44.0 | 1.9 | 41.6 | 33.4 | 164.4 | 94.3 | 0.3 |
| 1968 | | | | | | | | | | | |

Source: See table 34.

Table 36.--Percentage of total area planted to improved seeds in Colombia, by crops, 1953-67

| Year | Wheat | Corn | Beans | Irrigated rice | Barley | Cocoa | Soybeans | Grain sorghum | Cotton | Tobacco | Potatoes |
|---------|-------|------|-------|-------------------|--------|-------|----------|------------------|--------|---------|----------|
| Percent | | | | | | | | | | | |
| 1953 | 0.7 | 0.5 | | | | | | | | | |
| 1954 | 4.4 | 1.4 | | | | | | | | | |
| 1955 | 0.5 | 2.6 | | | | | | | | | |
| 1956 | 3.1 | 4.2 | 0.04 | | | | | | | | |
| 1957 | 2.8 | 7.0 | 0.3 | | | | | | | | |
| 1958 | 8.4 | 4.5 | | | | | | | | | |
| 1959 | 15.3 | 5.6 | 0.3 | | | | | | | | |
| 1960 | 11.2 | 6.2 | 1.2 | | | | | | | | |
| 1961 | 14.7 | 6.5 | 0.7 | 2.5 | | | | | | | |
| 1962 | 13.7 | 10.4 | 1.9 | 18.9 | 77.5 | | | | | | |
| 1963 | 15.5 | 9.8 | 3.3 | 25.1 | 89.0 | 100.0 | | | | | |
| 1964 | 15.6 | 14.3 | 2.1 | 38.5 | 71.2 | 100.0 | 100.0 | | | | |
| 1965 | 19.3 | 14.1 | 9.4 | 50.8 | 79.2 | 100.0 | 100.0 | 90.7 | 100.0 | 0 | |
| 1966 | 23.6 | 15.1 | 7.4 | 54.4 | 84.7 | 100.0 | 68.6 | 100.0 | 100.0 | 0 | |
| 1967 | 45.1 | 22.8 | 12.2 | 54.9 | 72.1 | 29.3 | 86.7 | 83.6 | 94.2 | 100.0 | 0.4 |
| | | | | | | | | | | | |

Source: See table 34.

Table 37.--Origin and percentage distribution of improved seed stock
in Colombia, by crop

| Crop | Number of types distributed | | | Percentage distribution | |
|-----------------|-----------------------------|----------|-------|-------------------------|----------|
| | Domestic | Imported | Total | Domestic | Imported |
| Beans..... | 7 | | 7 | 100 | |
| Corn..... | 17 | | 17 | 100 | |
| Potatoes..... | 1 | | 1 | 100 | |
| Wheat..... | 7 | | 7 | 100 | |
| Tobacco..... | 6 | | 6 | 100 | |
| Cotton..... | | 4 | 4 | | 100 |
| Rice..... | | 6 | 6 | | 100 |
| Barley..... | 3 | | 3 | 100 | |
| Soybeans..... | 2 | 3 | 5 | 40 | 60 |
| Grain sorghum.. | 2 | 2 | 4 | 50 | 50 |

Source: Departamento Nacional de Planeación, 1969.

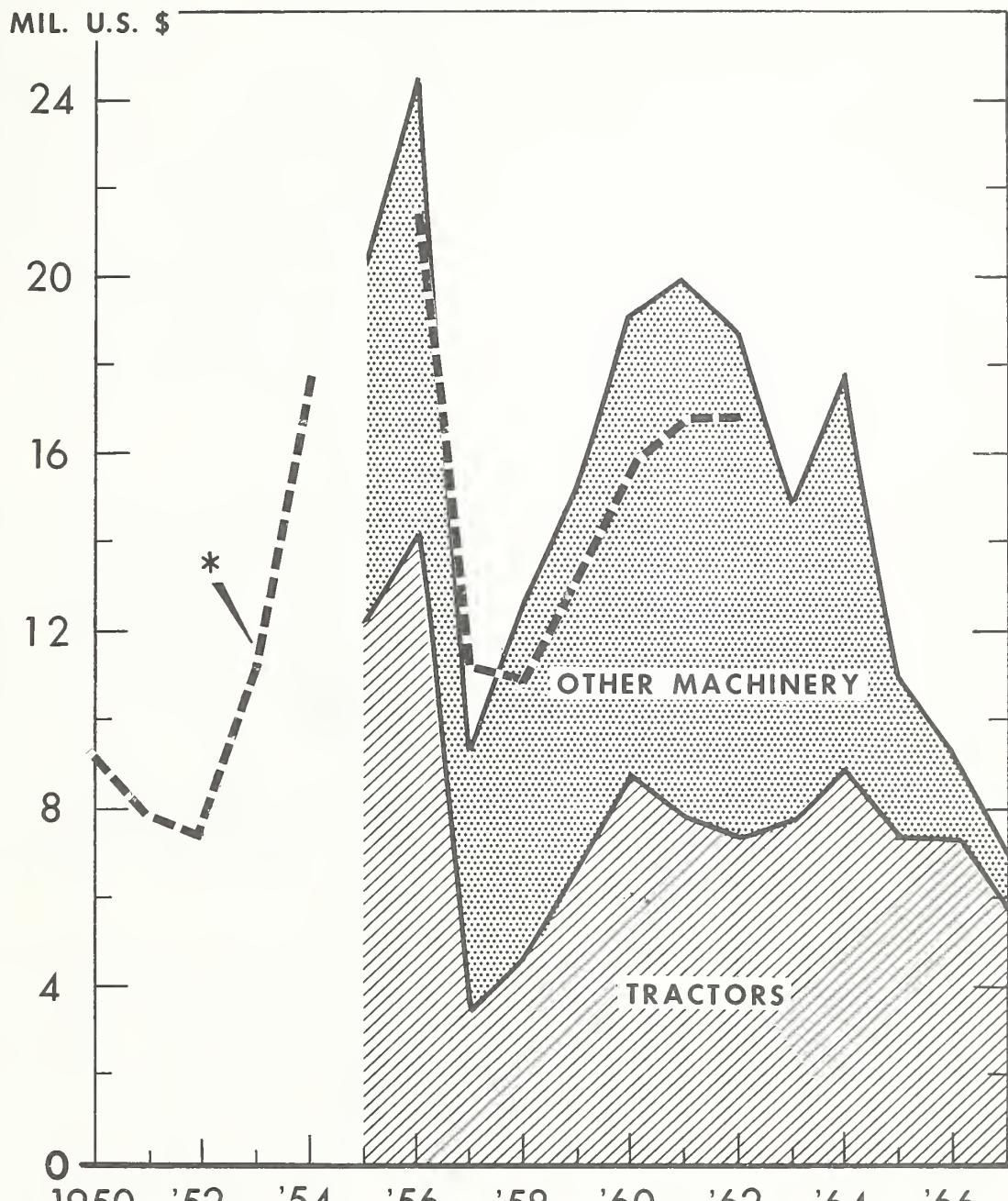
All in all, the substitution of improved varieties for prevailing common ones has proved to be a complex and difficult undertaking. The substantial effort of the Government has encountered numerous bottlenecks in development, multiplication, and distribution. In addition, the complementary nontraditional inputs needed to exploit the yield potentials of the improved seeds often have been lacking. The recent Government review referred to at the beginning of this section recounts these bottlenecks in detail as the prelude to proposing a program to accelerate progress in adoption of improved varieties.

Farm Machinery

Considerable mechanization of agriculture has taken place in Colombia since World War II. All machinery and implements were imported until 1962, when domestic production of simple implements and tools was begun. Mechanization proceeded most rapidly during the mid-1950's, when foreign exchange earnings from coffee were at a peak. Imports of agricultural implements were especially high during 1954-56, reaching a peak of around \$25 million in 1956 (fig. 26). After a sharp drop in 1957 and 1958, farm machinery imports picked up again and continued relatively high through 1962, indicating that farm mechanization was increasing. After 1962, restriction on imports, although relieved from time to time, was sufficiently stringent that the spread of mechanization was largely halted.

The principal information available is for tractors, which usually accounted for around half of farm machinery imports during 1953-67. The estimates of available tractors show the number rising from 9,000 in 1953 to 15,000 in 1959, 20,000 in 1963, and 23,000 in 1967. If these estimates are correct, they indicate a slowdown in tractor numbers after 1962, which seems plausible because of reduced imports in recent years. Furthermore, considerable information is available which indicates that the quality of the tractor stock has depreciated considerably during recent years because of the retention of a large proportion of aged tractors with seriously reduced work performance capacities. Although most tractors were relatively new in the earlier part of the period (having been imported during the preceding few years), about one-third were estimated to be more than 10 years of age in 1967. About 40 percent of the total stock was

VALUE OF COLOMBIA'S TOTAL IMPORTS OF AGRICULTURAL MACHINERY



*BROKEN LINES SHOW ESTIMATES BY CENTRAL BANK OF COLOMBIA.

estimated to be in a state of repair that varied from bad to ordinary (malo a regular), requiring major repairs (practically rebuilding and replacement of many parts) to put the tractors in condition to render acceptable service. 13/

The National Agricultural Bank (Caja Agraria) has calculated replacement requirements for tractors, based on a 10-year useful life (fig. 27). The rise in tractor numbers that are no more than 10 years old occurs until 1962. After that, a combination of higher replacement requirements and a reduction in imports are calculated to reduce the number of tractors in that "age" group. However, the rise in the price of tractors, and the restriction of imports would be expected to cause owners to retain tractors longer. The Caja has estimated that the number of effective tractors is about 18,000, which compares with about 15,000 calculated in figure 26. Much has been said and written about the unsatisfactory repair and maintenance services available for farm machinery and, especially, the shortage of repair parts. Casual observation suggests that this criticism is probably justified. The only mystery is the reported long life of tractors. But then private automobiles, taxis, buses and trucks all have long lives, despite high accident rates and bad roads. The Government has announced a program to improve supplies to facilitate repair and maintenance of farm machinery.

Other Machinery

For each 100 tractors in Colombia, it has been estimated there are 66 plows, 59 rakes, 38 planters, 47 cultivators, 25 farm wagons or vehicles (remolques) to be towed by tractors, and perhaps two or three portable irrigation systems. The one-third of the tractors without plows is a plausible estimate of those which are used for towing (about half of which are on sugar plantations) and not for plowing. Similarly, the estimate that there are less than half as many planters and cultivators is consistent with the common observation that tractors are less often used for planting and cultivating than for plowing.

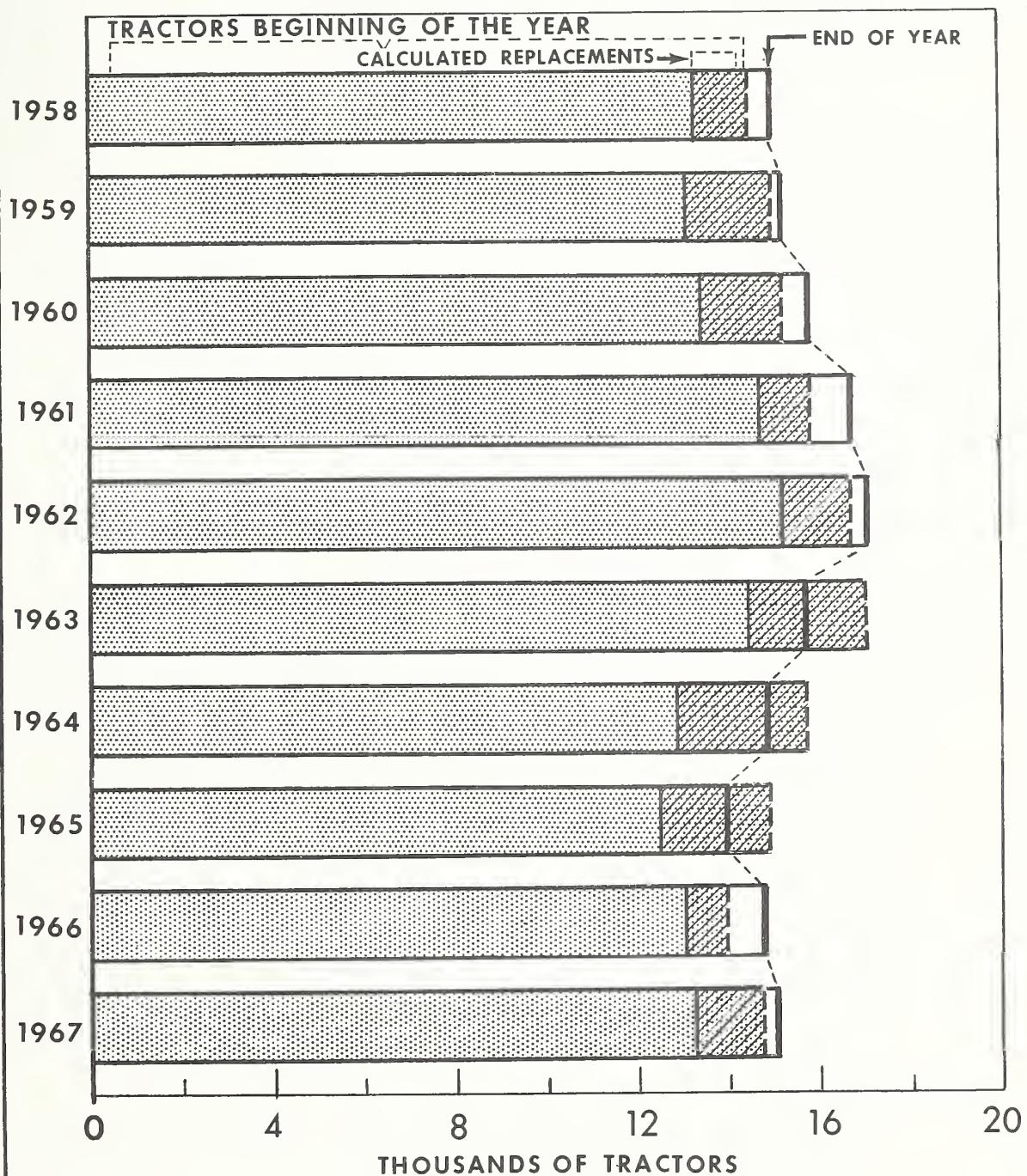
Industries within the country are now producing many hand tools (hoes, spades, picks, crow bars, machetes, and sickles) and repair parts, to save on the foreign exchange required for importation. These domestic products are usually made from softer materials and are often heavier than those imported, and prices have usually been about one-third higher (14, p. 53).

The Colombian Government has addressed itself to the conflict that arises in pursuing the agricultural policy goal of increasing use of farm machinery: that is, increased use of machinery expands output but reduces employment (see (5, pp. 17-18) for discussion of this problem). Machinery and implements imported are suitable for use primarily on rather large farms. They reduce costs, and for any given scale of operations, substitute for hand labor. On the other hand, they have been closely associated with the expansion in production that has occurred in the past two decades. The Government has taken two different steps to try to resolve this conflict. After considerable

13/ This section of the present report relies heavily upon (14, pp. 9-10).

AGRICULTURAL TRACTORS IN COLOMBIA

Changes in Number Based on a 10-Year Useful Life



SOURCE: NATIONAL AGRICULTURAL BANK (CAJA AGRARIA), COLOMBIA.

restriction of the imports of tractors during the past decade, the Government placed tractors on the free list in May 1968. 14/ Attention is being directed to the development of a small, simple, two-wheeled tractor suitable for use on small plots and fairly steep slopes. A prototype has been shown by the agricultural experiment station in a field day demonstration.

14/ This implies that licenses to import tractors are granted without restriction but prior deposits are required. The import duty of 2 percent is, in any case, negligible in view of the overvaluation of the currency.

CHAPTER V--EDUCATION AND OTHER COMMUNITY FACILITIES

General living conditions for farm people -- education, transportation, housing, and other community facilities -- affect agricultural production and productivity. Although these topics were not studied intensively for this project, other studies present a picture of these areas that is sufficiently precise for the purpose of this study.

In transportation, general progress has been remarkable, as a large proportion of the fixed investment of the nation has been directed to this area. All those who have known Colombia over a period of years, and especially returning visitors, stress the great progress that has been made. Nevertheless, rural roads leading to farms have received little attention, and the isolation of farms seriously limits potential agricultural development.

Systematic information on housing is limited to urban areas. The number of houses built each year is considerably below the annual increase in number of urban families, so that the housing deficiency is increasing. Inadequate shelters often constructed by the occupants in poor sections near the cities are the principal relief to multiple occupancy of the existing structures. Lack of systematic information for rural areas does not permit any assessment of housing there. However, numerous reports document inadequacies that constitute health hazards.

Educational Progress

Progress in education is less visible, but substantial. Since 1960, rural progress has been clearly evident. Nonetheless, the present condition of rural education remains so deficient that it generally limits the possibilities of youth. In 1964, more than two-thirds of rural schools offered instruction only through the second grade; most of the rest ended with the third grade.

Economic development of a country and educational levels of its citizens are related (table 38). Among the less developed groups, Latin America has the highest literacy rate, although it varies widely between countries approximately in accord with their level of economic development. In a compilation of 1967 income per capita and literacy in 19 Latin American countries, Colombia ranked 11th in income per capita and 9th in literacy (2). In terms of educational spending, Colombia devoted an unusually low proportion of the central Government's income to education. A more comprehensive measure of public education effort is the proportion of national income spent for public education. Colombia's 2.1 percent is also relatively low for countries in a similar stage of economic development.

Frederich Harbison and Charles A. Myers in 1964 developed a composite index to measure the level of human resource development. The basis for classification is the proportion of students enrolled in secondary and higher education. In this classification, Colombia ranked relatively low in relation to her stage of economic development. Out of 75 countries, Colombia ranked 48th in human resource development, compared with 35th in GNP per capita. Most countries that ranked near Colombia in the human resource development classification had lower income per capita, and some with a higher educational rating had lower income per capita (17, pp. 33-42).

Table 38.--Educational levels in developed and less developed areas

| Area | Literacy rate | Primary and secondary students as proportion of 5-19 age group |
|---|------------------|--|
| Percent | | |
| Developed areas: | | |
| Total | 96 | 77 |
| United States | 98 | 87 |
| : | | |
| Less developed areas, non-Communist: | | |
| Africa | 20 | 25 |
| East Asia | 58 | 44 |
| Latin America | 68 | 46 |
| Near East and South Asia | 29 | 35 |
| Average | 40 | 38 |
| : | | |

Source: U.S. Agency for International Development, Selected Economic Data for the Less Developed Countries, June 1969.

Another broad measure of education is the attainment level of the population. This information is available for Colombia from the population censuses of 1951 and 1964 (table 39). The proportion of the population who had received some school instruction rose substantially during this period, from less than two-fifths in 1951 to more than half in 1964. Of those who had attended school, the proportion reaching the various levels changed little between the two dates. About 85 percent had received instruction only in the primary grades (1-5), while only about 11 percent had reached any of the secondary grades (6-11). A little over 1 percent had completed 11 grades, and 1 percent had received some college instruction. Information on the grade attained was unavailable for 2 percent of the population who had attended school. The considerable increase in the proportion of the population who had received instruction between 1951 and 1964 was not accompanied by any significant change in the dropout rate. If the common standard is applied that 4 years of instruction are required to achieve minimum literacy and understanding of simple mathematical relationships, then in 1964, of those who had attended school, 57 percent had not reached this level of instruction -- that is, the fourth grade. Enrollment in the fourth grade was less than one-fifth of that in the first grade (17, p. 79)

The figures in table 39 may be interpreted to show that less than one-fifth of the population had received instruction beyond the third grade in 1951 and a little over one-fifth in 1964. The direct measurement of illiteracy by the censuses shows a much lower rate than would be implied by the above calculation as well as substantial reductions from one census period to another (table 40). Between 1938 and 1951, the illiteracy rate declined from 42 to 38 percent, and then more rapidly to 27 percent in 1964. In the earlier period, most of the decline was in urban areas, whereas in the latter period substantial progress was made in rural areas as well. In 1964, illiteracy was reported at 15 percent in urban areas, compared with 41 percent in rural areas.

Table 39.--Population by level of instruction and school grade completed,
Colombia, 1951 and 1964

| Item | : | 1951 | : | 1964 |
|--|---|---------------|---|---------------|
| | : | <u>Number</u> | | <u>Number</u> |
| | : | | | |
| Total population..... | : | 11,862,000 | | 17,484,000 |
| Population which had received some instruction..... | : | 4,669,305 | | 9,245,555 |
| Of which: | : | | | |
| Percentage that had received primary instruction..... | : | 86.4 | | 84.6 |
| 1st grade..... | : | 16.1 | | 16.2 |
| 2nd grade..... | : | 22.5 | | 21.7 |
| 3rd grade..... | : | 20.0 | | 19.5 |
| 4th grade..... | : | 17.2 | | 13.9 |
| 5th grade..... | : | 10.6 | | 13.3 |
| Percentage that had received secondary instruction..... | : | 11.0 | | 11.2 |
| 6th grade..... | : | 2.2 | | 2.9 |
| 7th grade..... | : | 2.7 | | 2.6 |
| 8th grade..... | : | 2.2 | | 2.0 |
| 9th grade..... | : | 1.7 | | 1.5 |
| 10th grade..... | : | 1.0 | | 0.8 |
| 11th grade..... | : | 1.1 | | 1.4 |
| Percentage that had attended college..... | : | 1.0 | | 1.1 |
| Other class or without information..... | : | 1.6 | | 3.1 |
| | : | | | |

Source: Census of Population, 1951 and 1964, DANE.

Table 40.--Illiteracy rate in Colombia, 1938, 1951, and 1964

| Year | National | | | Urban | | | Rural | | |
|---------|----------|------|-------|-------|------|-------|-------|------|-------|
| | Total | Men | Women | Total | Men | Women | Total | Men | Women |
| Percent | | | | | | | | | |
| 1938 : | 42.4 | 40.1 | 47.1 | 25.4 | 20.7 | 29.0 | 53.4 | 49.2 | 57.6 |
| 1951 : | 37.7 | 35.0 | 40.3 | 21.0 | 16.6 | 24.5 | 49.7 | 46.1 | 53.6 |
| 1964 : | 27.1 | 25.2 | 28.9 | 15.0 | 11.9 | 17.4 | 41.3 | 38.4 | 44.4 |
| : | | | | | | | | | |

Source: Albert Berry, Welfare of the Agricultural Population Through Time and Its Determinants. Unpublished. Based on Censo de Poblacion de Colombia, 1964, DANE.

A principal limitation of rural schools is that more than two-thirds of them offer instruction for only 2 years (table 41). Another fifth offer 3 years of instruction, but only 8 percent offer 4 years. Four percent offer the full 5 years of primary instruction. Primary schools are considerably more adequate in urban areas, with 62 percent offering the full 5 years.

Table 41.--Number of primary schools, by years of instruction offered, Colombia, 1964

| Years offered | Total | | Urban | | Rural | |
|---------------|--------|---------|--------|---------|--------|---------|
| | Number | Percent | Number | Percent | Number | Percent |
| 1 year | 1,215 | 5.1 | 324 | 4.6 | 891 | 5.4 |
| 2 years | 11,065 | 46.9 | 591 | 8.4 | 10,474 | 63.1 |
| 3 years | 3,871 | 16.5 | 721 | 10.3 | 3,150 | 19.0 |
| 4 years | 2,343 | 9.9 | 990 | 14.1 | 1,353 | 8.1 |
| 5 years | 5,116 | 21.7 | 4,380 | 62.5 | 736 | 4.4 |
| Total | 23,610 | 100.0 | 7,006 | 100.0 | 16,604 | 100.0 |
| : | | | | | | |

Source: 1964 Census of Population, DANE.

The proportion of school-age children attending school showed a substantial rise between 1951 and 1964 (table 42). In urban areas, the proportion of males 10 to 14 years old attending school rose from 60 to 76 percent. Comparable advances at lower percentage rates occurred for younger and older groups. Female attendance in the younger age groups (5 to 9 years old) was only slightly lower than male attendance but was far lower in the older groups (15 and above). In rural areas, for the younger group, the proportion attending schools is about half as high as in the cities. For rural males 5 to 9 years old, the proportion rose from 12 percent in 1951 to 15 percent in 1964, and for males 10 to 14 years old, from 29 to 41 percent. These are appreciable improvements, but the level still reflects inadequate resources devoted to rural education. Some increase occurred in the percentage of secondary age youths (15 to 17 years old) attending schools in rural areas, but male attendance remained below 10 percent in 1964 and female attendance was still lower.

Table 42.-- Proportion of specified age groups in school, by sex, for total, urban, and rural population in Colombia, 1951 and 1964

| Age of population | Total population | | Urban Population | | Other regions or rural population | |
|-------------------|------------------|-------------|------------------|-------------|-----------------------------------|-------------|
| | Male : Female | | Male : Female | | Male : Female | |
| | 1951 : 1964 | 1951 : 1964 | 1951 : 1964 | 1951 : 1964 | 1951 : 1964 | 1951 : 1964 |
| Percent | | | | | | |
| 5-9..... | 17.3 | 25.6 | 17.6 | 26.3 | 27.5 | 36.9 |
| 10-14.... | 39.7 | 58.2 | 38.0 | 56.1 | 59.6 | 76.2 |
| 15-19.... | 13.7 | 26.6 | 9.5 | 22.0 | 26.6 | 43.2 |
| 20-24.... | 2.8 | 5.9 | .9 | 2.3 | 6.2 | 10.6 |
| 25-29.... | .6 | 1.0 | .3 | .4 | 1.3 | 1.8 |

Source: Censo de Población de Colombia, 1951, Resumen, table 11, p. 37, and table 39, p. 188. XIII Censo Nacional de Población (Julio 15 de 1964) Resumen General, table 7, pp. 334, and table 41, pp. 143.

Table 43.--Attrition rates in rural public schools in Colombia, selected years

| Year entered | Men | | | | Women | | | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|
| | Passed | | Passed | Passed | Passed | Passed | Passed | Passed |
| | first | second | third | fourth | fifth | first | second | fifth |
| year : year | | | | | | | | |
| 1958..... | 54.6 | 31.5 | 5.01 | 1.78 | .79 | 58.9 | 35.6 | 5.47 |
| 1947..... | 48.5 | 31.4 | 3.20 | .71 | | 50.4 | 23.5 | 3.03 |
| 1941..... | 42.9 | 26.5 | 3.26 | .41 | | 44.5 | 28.7 | 3.42 |
| 1937..... | 58.2 | 33.2 | 8.8 | .72 | | 59.7 | 35.5 | 9.4 |

Note: In each ratio, the year entered is the first year the student attended school.

Source: Albert Berry, Welfare of the Agricultural Population Through Time and Its Determinants. Unpublished.

Albert Berry has made calculations to show the dropout rates in rural schools for selected years since 1937 (table 43). One can detect some increase in dropouts from the pre-World War II period to the years following the war, and then some decline. For the most recent student group for which calculations can be made, the dropout rates are almost incredibly high unless one remembers that most rural schools offer only 2 years of instruction. A little over half the students pass the first year, about one-third pass the second year, and only 5 percent pass the third year.

Financing Education

Many studies indicate that the qualitative aspects of education in Colombia are consistent with the quantitative (19). Both reflect the limited resources made available for education. The Colombian Government has not been able to increase the proportion of tax revenues to national income or gross national product for complex reasons which have been analyzed and reported in comprehensive tax studies. As other demands on Government revenues have been large and growing, the proportion available for education has shown only small change over a long period of years. State and local funds have also been limited in relation to the needs of a rapidly growing population. These fiscal limitations have thwarted numerous and sustained efforts to obtain faster progress in education. National leaders are committed to improving and extending education, but financing difficulties have limited plans for rapid improvement. There is no lack of interest or appreciation at the local level of the benefits of education. But, as has been attested to in a long series of studies including those referred to above, the capacity of local governmental units to provide education and other community services has been severely restricted. It should be mentioned that financing from abroad has helped reduce the deficit in educational resources.

Meanwhile, vocational and technical training, financed principally by compulsory contributions from private employers, has made a notable contribution to providing the skills needed for industry, commerce, services, and agriculture. The National Apprenticeship Service (SENA) has developed a diversified program with special instruction centers, on-the-job training, and other courses offered outside centers. Enrollment reached 70,000 in 1967.

Education is not an independent and isolated problem. Although no functional relationships have been calculated to show how lack of education of the Colombian population limits the country's economic development in general and agricultural development in particular, it is reasonable to judge that rural education in Colombia is so seriously deficient that youths who remain on farms are handicapped in their capacity to comprehend and adopt better farming methods and techniques. 15/ Severely limited upward mobility constitutes an outstanding characteristic of small-scale Colombian farmers. Broader implications for the development of agricultural leadership and for entry into nonfarm pursuits will not be commented upon here.

15/ Paul T. Schultz has calculated returns from investment in various levels of education (28).

This chapter has two parts. The first examines differences in the rate of expansion and technological progress within Colombian agriculture during 1950-67. The second considers some changes that appear essential if progress is to accelerate in the immediate years ahead.

One of the outstanding characteristics of technological progress in Colombia is that it has been rapid in some areas and crops and slow in other areas and crops. The first step taken here is to compare the groups expanding rapidly and making good progress with those showing limited change. The aim is to try to ascertain the conditions which appear to foster or to retard progress. Specific changes in crops and shifts in technology are considered.

The interpretation of why these changes occurred at varying rates, and the appropriate method of viewing the problem and of classifying farmers or crops are all unsettled and controversial. This chapter is a tentative interpretation.

Unfortunately, there is no relatively simple difference or apparently strategic factor or small group of influences which divide the "progressive" farmers from the slowly changing or traditional group. The successful have so many advantages that expansion seems easy and natural, whereas the small farmers on the hillsides appear to be "locked in," with many potent reasons for not expanding.

In addition, it must be recognized that the progressive farmers are only "relatively modern" and still have considerable possibility to produce more efficiently at lower costs, and more flexibility to expand the size of their operations than the traditionalists. Similarly, almost any general aid provided by the Government is likely to be more helpful to the progressive, expanding group -- and more quickly utilized by them -- than to the traditionalists, unless such help is specially slanted toward the latter.

Indeed, one of the inferences of this chapter is that more special help will be required for the great majority of small traditional farmers if they are to participate in agricultural expansion. An attempt is made to specify their special difficulties that could be partly relieved with short-run type adjustment, principally the use of nontraditional inputs. It is recognized, however, that such changes will be impeded if basic long-run problems are neglected.

The limited progress of small farmers to date and the restricted options now available constitute a challenge for the development of a program designed to lower the barriers impeding expansion and modernization.

Characteristics of Expanding Agriculture

Selected Crops

Expansion in agricultural production has been limited to the small number of crops in group 5 (cotton, rice, and sugar) and 5A (sesame, barley, soybeans, and grain sorghum). Livestock and livestock products expansion,

principally in poultry and eggs, is sufficiently different that it will be considered separately. Crops in groups 5 and 5A are not tropical. Except for barley, they are all grown in subtropical areas both in Colombia and in Southern States of the United States. But, to summarize, almost all of the expansion in Colombia is in these crops in warm-climate areas.

Type of Land

Expansion has been principally on level land of high fertility, often in new alluvial valleys not previously cultivated. In these fertile soils, yields have been high without use of fertilizer, and until the present, the response to the quantities of fertilizer that has been used has often been rather limited. As a consequence, the whole technique of modern soil management will need to be further developed and applied, to improve the present rather good yields obtained. 16/

Location

The new acreage cultivated is mostly near large cities with moderately good transportation in areas that at least now are well developed generally, with good availability of nontraditional inputs. A partial exception is the principal cotton-producing area near Valledupar, in the old state of Magdalena, now Cesar. This area has developed as a result of modern crop cultivation.

Nontraditional Inputs

Improved varieties are the rule, with wide use of chemicals to control diseases, insects, and weeds. Most of the seedstocks for the improved varieties have been imported. 17/ Usually the seeds have been multiplied, with limited development in Colombia. Cultivation is by tractors, with little use of hand cultivation. Harvesting is less fully mechanized, with considerable adaptation occurring; low-wage labor is used for cotton and sugarcane.

Tenure and Size

Much of the expansion is by renters or part-time farmers who often do not live on the farm. As suggested by the fact that tractors and other purchased inputs are used on these farms, the scale of operation is large in relation to traditional crop culture.

Characteristics of Traditional Agriculture

It may be recalled that traditional crops were divided into two groups: the strictly traditional group 2 -- yuca, beans, plantains, and noncentrifugal

16/ This interpretation was made by agronomist James Haynes, formerly of AID, Bogotá.

17/ A summary of the source of improved varieties which have been distributed for the crops in groups 5 and 5A is as follows: For group 5 (cotton, rice and sugarcane), 100 percent was imported. The cotton and rice are from the United States, and the sugarcane is from Hawaii and Costa Rica. For group 5A, 100 percent of the improved varieties of sesame seed were imported from Venezuela; an estimated 50 percent of the grain sorghum and 60 percent of the soybeans distributed was from varieties imported from the United States. None of the improved barley seed distributed was from an imported variety; all of it was from varieties developed in Colombia. For more details, see table 37, p. 74 of this report, which gives the results of a survey of seed distributors in Colombia.

sugar (panela) -- and the mixed group, group 3, which embodies both traditional as well as nontraditional culture -- corn, potatoes, wheat, and tobacco. The characteristics of farms and farmers in traditional agriculture are almost the opposite of those producing crops in groups 5 and 5A.

Selected Crops

Traditional farmers produce primarily yuca, beans, plantains, and noncentrifugal sugar (group 2) as well as crops of the mixed technology (group 3), using principally traditional inputs and culture. The climate range is broad, with concentrations in the warm (but not hot) climate and the cool zones. Although coffee is produced principally by relatively small farmers, with little use of nontraditional inputs, the coffee farmers stand out as a special group, more prosperous and less disadvantaged in several of the following characteristics.

Type of Land

Traditional agriculture is located principally on land ranging from rolling, broken terrain to incredibly steep slopes, and is seldom found on level land of high fertility.

Location

Most of the farms are located in the mountainous areas, which are often inaccessible by wheeled vehicles, making markets for both final products and purchased inputs difficult to reach. Some expansion is occurring on adjacent slopes in higher altitudes and in remote frontier colonies on the edge of the eastern plains and jungle.

Type of Inputs

Inputs are mainly traditional; the principal exceptions occur in the production of potatoes and, in a limited way, tobacco. Cultivation by hand is the rule.

Tenure and Size

Excluding tobacco farmers and farmers with less than 2 hectares (mainly part-time farmers and sharecroppers), traditional farmers are typically owners. The great majority of tobacco growers are essentially sharecroppers who are directly dependent on the owners not only for the land but also for the "furnished" supplies needed for producing the crop. Of the total of about 750,000 farmers with 2 or more hectares in 1966, about two-fifths had between 2 and 5 hectares, with an average of less than 2 hectares in cultivation; one-fifth were in the 5-to 10-hectare group, with an average of 3 hectares in cultivation. The area cultivated tends to be limited to that which can be handled by hand culture. Oxen are used in some sections, and custom tractor plowing is important in others. Horses and mules are not used for plowing and cultivating in Colombia.

In addition to the five characteristics discussed above which are in contrast to those of the expanding group of farmers, there are additional, related characteristics which tend to limit increases in output and productivity in traditional agriculture.

There is a lack of knowledge about "modern" inputs which are now available in Colombia for crops with a nonlocal market. Although farmers generally are aware that improved seeds have been developed in experimental trials and that fertilizers and insecticides will increase yields, they lack the precise recommendations and directions to select and to apply these nontraditional inputs.

Supplies of modern inputs are not readily available, and according to widespread complaints, those inputs that are available are sometimes of poor quality.

Most of the product markets are "thin" and easily saturated; thus, it is risky for a farmer to expand. For the products sold on the local market and consumed in the community area, the danger of reducing the price may be real for the individual producer. More generally, the threat of market saturation discourages expansion in production.

The education and training level of traditional farmers is low. A possible final characteristic has been noted, but no agreement has been reached as to its validity or significance. It is an attitude of discouragement about the possibilities of improving one's lot by increased effort and adoption of new methods, as well as a feeling of alienation from the Government and public agencies -- from whom the farmers feel that nothing desirable or helpful can be expected.

Although this attitude has been reported in a number of studies of small Colombian farmers in relatively isolated areas (the best known of which is Orlando Fals Borda's study of Saucío (7), 18/ a village on the Sabana plain not far from Bogotá), other serious observers of the Colombian scene have characterized it as a myth.

The latter stress that the small farmer is doing the best he can with the handicaps under which he is laboring, and that he often would not be resistant to change if he had feasible, promising opportunities. He may have exhausted the limited alternatives available within a traditional setting, but be rather quick in adopting new varieties and the appropriate other nontraditional inputs where the incremental benefits are large in relation to incremental costs. In several developing countries, rapid adoption of high-yielding grain varieties has extended to small farmers who had previously used only traditional culture. However, such profitable technological innovations have not been available for small farmers in Colombia.

It is a challenge to the Government to provide the combination of conditions essential to reverse the influence of the long list of unfavorable factors restraining expansion by small traditional farmers. Without such action, the small farmer seems to be "locked in" and apparently nonresponsive to price and profitability. This apparent slowness in adaptation is in relation to the accelerated changes that are occurring throughout much of Colombia in transportation, communication, and agricultural practices. The small farmer may be changing and adapting more rapidly than in the past and still falling farther behind in the accelerated technological advance in which a considerable part of Colombian agriculture is participating.

Some economists who have studied Colombia and other developing countries point out that the above distinction between small, poor, traditional farmers and large, modernizing, expanding farmers is drawn too sharply. Adams, Geurra, Warnken, Wheeler, and Witt (1) emphasized the variety in Colombian agriculture and the importance of general farming as opposed to specialization. They stress

18/ See also A. Eugene Havens (18) -- 1 of a series of studies of the Land Tenure Center of the University of Wisconsin.

that the size, ownership, and control patterns vary greatly and that vertical mobility is an important reality and not just an occasional exception. Breakthroughs in yields have occurred for small farmers in other countries, especially Taiwan, Japan, and South Korea, and, with the new high-response grain varieties, in West Pakistan and India. It seems appropriate to distinguish between non-traditional inputs that are clearly related to scale, such as mechanization and power, and those inputs that are freely divisible into small units, such as fertilizer, better seeds, and pesticides. These distinctions, and the developments occurring in other countries, are all relevant to what could be taking place in Colombia, or what already may be beginning but is not yet apparent in summary statistics.

Colombia's agriculture is better characterized as a dual rather than a "transitional" economy. There are two different groups of farmers, with relatively little expansion and net upward mobility occurring for the small farmers.

"Transitional" agriculture, on the other hand, implies a general movement from traditional to modern agriculture; that is, the transformation that is the goal of planning.

Expansion Possibilities in Traditional Crops

Nevertheless, we wish to consider the problem of expansion in a slightly different context in the form of two questions.

1. If many of the limiting factors mentioned above could be overcome, would it be profitable for the small farmer to expand in the traditional, or semitransitional (group 3, mixed) crops which he has cultivated? In other words, what are the probabilities for success, if the farmer has access to the improved seed that has been developed, to fertilizer of the appropriate type and of dependable quality, to chemicals for disease and weed control (or access to such services), to advice on unfamiliar routines, and to a market that is nonlocal?

2. Why do relatively modern farmers who have the resources and the disposition to expand usually avoid the traditional crops and choose the non-traditional crops of groups 5 and 5A (as well as poultry and eggs)?

These are difficult questions, which cannot be answered categorically. Information about present production processes and markets will permit some assessment of the probability of various kinds of expansion now possible with present techniques and policies.

Soil scientists and agronomists have emphasized that soils cultivated under traditional agriculture are generally deficient in the principal elements provided by commercial fertilizers, and that they do give good yield response to fertilizers if weeds and diseases and insects are controlled. Plant breeders point out that the response to fertilizer can be greatly increased if improved varieties are substituted for the common varieties usually grown. The high-response grains that have become so important in several developing countries are the most dramatic examples of improved varieties.

There is a great shortage of specific research results on improved methods of producing the principal traditional crops of yuca, sugarcane for panela, and plantains. Yuca for direct food use is a product that is highly perishable after it is harvested. It is grown principally as a subsistence crop or for sale in local markets. Yields are low in Colombia. The possibility of producing yuca for processing into starch or flour and for animal feed has received some attention in Colombia. Quite different varieties from those now grown would seem appropriate. Trials are being made of a high-yielding variety grown in Brazil. A more remote possibility is that the nutritive value of yuca may be enhanced or fortified, thus broadening the market.

Sugarcane for noncentrifugal sugar has available the improved varieties that have been developed for sugar production, but they are rarely used. On several farms in the Cauca Valley, cane for panela is grown with relatively modern technology and is transported by trucks or by tractors with special vehicles attached (as in the case of cane for sugar) to processing plants of large capacity.

In contrast to production of yuca, relatively modern production of panela is an actuality in Colombia, but it is limited to a few farms in the fertile Cauca Valley. They are, so to speak, peripheral to the great sugar plantations. Meanwhile, more than 250,000 farmers grow sugarcane, principally under strictly traditional culture. There appears to be a great gap between the small, traditional growers, and the few large, relatively modern panela producers. Thus, the technology for nontraditional culture is available and in use on a limited scale.

Plantains (plátano) are even more of a subsistence crop than panela, and are more rarely grown with the use of nontraditional inputs. This crop is more widespread, with more than 400,000 farmers growing some plantains. From the 1966 tabulations of the DANE agricultural sample census by size of farm, it is reported that only farms above 20 hectares in size have an average of as much as 1 hectare in plantains, and only those of more than 100 hectares have an average of 2 or more hectares in plantains. The largest farms (over 2,500 hectares) that report plantains average a little over 3 hectares of the crop. To be sure, its close association with coffee (providing shade) complicates the decision as to the profitability of expanding plantain production. In any case, there is less use of nontraditional inputs in growing plantains than in growing panela. Two intermediate-size farms specializing in plantains are reported to be using improved cultural practices, especially disease control practices. They are located in the Cauca Valley and produce for the Cali market.

The final traditional crop considered here is edible beans. Most of the production continues to be traditional, but some formal experiments have been made, and improved seed varieties have been produced. Again in the Cauca Valley, some farms are producing beans with nontraditional inputs on a commercial scale. 19/ The apparent gap between these two types of production may be so wide that the commercial scale may not be a real option available for small, traditional farmers.

19/ Extreme variations in prices are reported to be a principal influence limiting bean production (16).

Expansion Possibilities in Other Products Except Those in Group 5

Before turning to the crops in groups 5 and 5A, where substantial expansion has occurred, it is appropriate to consider the influences affecting expansion in an intermediate group of products, such as coffee, the "mixed technology" group -- specifically, corn and wheat -- and cattle. For these products, considerably more experimental information is available, and production systems using nontraditional inputs have been developed that are much more productive than the strictly traditional systems which persist and still account for the great proportion of total production.

The principal question here is, Why do we not find a considerable expansion in production with nontraditional inputs for these commodities?

There appear to be two types of situations: (1) traditional cultivation, usually small scale, is characterized by low yields that are just moderately profitable in the case of coffee, and that permit only a subsistence crop in the case of corn; and (2) production using nontraditional inputs results in high yields that appear to be profitable. The inference is that expansion of production under traditional cultural practices is not sufficiently profitable to be attractive. For coffee, it does appear profitable to adopt non-traditional technology, planting the high-yielding sun-grown variety and fertilizing. Furthermore, for the owner with a rather large sum of available capital or credit (the latter implying he is an urban resident), changing to nontraditional technology seems moderately simple; that is, well within the capabilities of managers and workers available and not risky in the sense that using untried or unfamiliar technology would be. There are numerous examples of coffee producers now using nontraditional inputs. The possibility of more and more doing so constitutes a threat to the voluntary program to reduce coffee production. Regardless of the desirability of an expansion in total coffee production, individuals may expand and market sun-grown coffee at the same price as the shade-grown product. However, for the small, traditional coffee grower, the shift to sun-grown coffee is not easy. Perhaps the principal restraint is that it requires large capital investment.

For corn, the immediate possibilities for expansion are less attractive and involve less well-known technology. It is not profitable for farmers using traditional technology to expand production specifically for the market. Expansion with nontraditional inputs involves rather new developments, but it is occurring in at least three separate regions -- the Cauca Valley and two areas on the Atlantic Coast. Because of the shift in population from the farms to the cities, where corn consumption declines in favor of wheat products, the market for corn as a food is not expanding as fast as population growth. However, the long-term prospects for market expansion are favorable for corn produced for livestock feed or milling products.

The great promise of high-lysine corn, with its improved protein content, is important for corn grown for both food and feed. This corn once had lower yields than other improved varieties but the difference is now small. In fact, it appears to be negligible for high-lysine corn grown under field conditions. Seed was in sufficient supply to be distributed on a limited basis in 1969. Also, there are no significant changes in culture to impede adoption.

Trials for use of high-lysine corn in hog rations are very promising. 20/ They are also especially appropriate in Colombia, where hog production has been unprofitable and languishing at a low level. In fact, commercial hog production has been at such a low level that systems of management are not well established even at the experiment station level. Some experimental work is now in progress. There is very little similarity between the management practices known and followed by the peasant keeping one or two pigs and the practices that will be required for modern hog production. The gap is so wide that modern production may not now be an option for the peasant who has raised a few pigs a year. As in the case of the commercial crops of groups 5 and 5A, what seems more likely is the entrance of a whole new group of operators with considerable capital and the training necessary to comprehend and adopt systems of management similar to those followed now on a very few farms -- perhaps less than a dozen -- in Colombia.

Nevertheless, the gap can be reduced by governmental effort to teach the present farmers improved practices, extending the experimental results that are beginning to accumulate. Such positive action is an objective of the newly reorganized extension service.

In the case of wheat, the prospects for expansion are not attractive. High yields have been obtained on an experimental basis, but commercial yields have not been very profitable even under the best of practices that have been adopted. The period of growth and harvest is rather long in the high areas adapted to wheat, so that double cropping is restricted. In contrast to the corn situation, there are no areas where expansion of wheat, using present technology, is clearly profitable.

The situation for potatoes is a little more complex. The special characteristics of technology for potatoes have been referred to in (5, p. 12). A distinguishing characteristic is that small farmers are using some nontraditional inputs -- specifically fertilizer and pesticides -- as well as credit (subsidized) to finance them. Potatoes require so little land in relation to labor that expansion in output is less dependent on owning expensive machinery than in the case of less intensive crops.

A new study by Christopher Andrew concludes that the limited availability of improved seed and information about its use restricts producers' ability to increase yields. Price instability was found to be the major marketing problem (4, pp. 202-204). Potato prices have fluctuated through an extreme range from year to year in a manner that is similar to the situation in the United States, but the range of prices has been more extreme in Colombia. In contrast to the market for locally traded products, such as yuca and plantain, the potato market is sufficiently broad that an individual producer will not need to consider his expansion's effect on price.

A final note may be added about expansion and technology for beef production. Here the production unit is not small; the concern is not with small

20/ It should be noted that the promising prospects for the use of corn for hogs are for the future, after the price of corn has been sharply reduced. In the autumn of 1968, the price of corn in Colombia (Medellin market) was about twice as high as the price prevailing in world markets.

farms but with livestock ranches that range in size from intermediate to very large. Cattle slaughter has not kept pace with population growth during the past two decades. The possibilities for expansion into the export market have been assessed as favorable, and various plans for expansion have been announced. Credit has been rather freely available, with special domestic funds supplemented by international loans. It is too early to ascertain the success of the recent expansion effort. In recent years, cattle slaughter has shown little change. Since cow slaughter has been reduced sharply, it is probable that breeding herds are being built up for a future expansion in marketings. Exports of cattle and beef showed some expansion in 1969 and early 1970.

A survey of ranches conducted by the organization of livestock producers (FEDEGAN) indicates that the level of technology is quite low, even in the areas which have the better ranches. A series of questions about "recommended" practices revealed that few of them are being used anywhere, and thus the results of such practices could not be observed. Seldom was any considerable combination of them used on any ranches other than those specializing in purebred cattle for breeding purposes. Accordingly, it is important to point out that we have few empirical results to show how profitable such practices would be under Colombian conditions. On the other hand, the technology of beef cattle production is not so mysterious, and superior practices have been tried and adopted in countries with climatic conditions similar to Colombia's. The judgment of livestock specialists that Colombian ranches are technologically backward and that they would be more productive and profitable with the use of improved technology seems plausible. 21/ In any case, considerable improvement is essential to any expansion that would be fast enough and great enough to permit announced export targets to be met.

This section began with the question of whether it would be profitable for peasants to expand in traditional crops under favorable conditions with the technology which is known but not fully disseminated. We then considered mixed technology crops, and finally livestock -- thus completing the survey of the possibilities for expansion in traditional agriculture other than in the relatively modern agriculture of groups 5 and 5A (and poultry and eggs). The difficulties and uncertainties of applying presently available improved technology to traditional agriculture turned out to be rather significant. Expanding and increasing output of these crops appears difficult for the small traditional farmer, who often is unfamiliar with improved practices. It would also be relatively risky for commercial farmers with modern equipment, adequate capital or credit, and good management ability to venture into production of these traditional crops. If these conclusions are essentially true, they largely answer the questions as to why expanding farmers usually avoid the traditional crops and mixed technology crops in favor of those in groups 5 and 5A (as well as poultry and eggs).

To the uncertainties of adapting improved technology to traditional crops are added marketing uncertainties. On both points, the traditional crops compare unfavorably with those in groups 5 and 5A, with their better known technology and better markets. Producers' organizations have reduced the risks of price

21/ A contrary opinion may be noted. James E. Grunig reports that often attempts to adopt improved practices on livestock ranches did not bring anticipated increases in production and were not generally profitable (16).

declines in the principal commercial crops under varied marketing conditions. They have also given valuable help to their members in importing improved seeds and developing a quality product, enforcing sanitation and disease control regulations, and promoting improved nontraditional inputs in a coordinated fashion that has ensured their application (that is, by disseminating information and making recommendations on application and general practices, purchasing at reduced prices, and distributing at the proper time). All of these are essential functions which are not available for the producers of traditional crops, and their lack discourages expanding farmers from selecting these crops.

Expansion Possibilities for Traditional Farmers in Group 5

One possibility this report has not yet considered is that of traditional farmers adopting relatively modern technology and producing crops in group 5 and 5A. Since expansion in these crops is less risky, involves better known technology and more readily available nontraditional inputs, and is generally more profitable than expansion in traditional crops, could not traditional farmers enter this more profitable area? If they do, they will usually be more competitive if they are able to use land suitable for mechanization, and they will have to adopt nontraditional technology to compete successfully in growing these crops. This has been demonstrated in the case of cotton, where a long-established traditional production system has been supplanted by a relatively modern one by large producers (25, pp. 147-148).

A considerably different situation prevails for rice, where traditional production continues to be important despite expansion by relatively modern producers. The small farmers, continuing to use traditional farming methods, obtain low yields and have shown little expansion. In other developing countries, improved farming methods that do not depend on mechanization have been adopted, but they have not been available to small farmers in Colombia. Until the present, many of the requisites for modernization and expansion in rice production have not been available to small farmers. Thus, few of them have made the transition. Most of these essentials are now provided rather effectively by the rice growers' association for its members, and presumably could be offered by the Government for small farmers. The development or procurement of high-response varieties would facilitate the transition from traditional methods, as has been demonstrated in other countries.

Sugarcane for sugar is the other big expansion crop in Colombia. Small farmers have not had the option to participate in the expanding, supported market for sugar. (Their production is too small to obtain a contract for delivery of cane to a centrifugal sugar mill and their farms are seldom located near such a mill.) For the crops in group 5A -- sesame, barley, soybeans, and grain sorghum -- small farmers have not participated in the expansion, which has usually involved mechanized plowing, cultivation, and sometimes harvesting. Since some small farmers have experience growing two of the crops -- barley and grain sorghum -- it is probable that with Government assistance, small farmers could expand production of these crops.

In general, the traditional farmer has had obstacles limiting his entry into nontraditional production of crops of groups 5 and 5A, and the number making the transition has been limited. Some of the projects of INCORA are aiding and

supervising farmers in the attempt to make this change, sometimes providing machine operations for plowing, seeding, and harvesting from a central source. Small tractors have been little utilized, but cooperative or custom arrangements for tractor operations are of some significance. Improved technology suitable for small farmers (for example, fertilizer, pesticides, and better seeds) has been adopted in several developing countries, and might be developed for Colombia with Government assistance.

Poultry Enterprise Adaptable to Small Farms

A type of farm enterprise with modern technology available which is more easily adapted to small, traditional farms is poultry and egg production. The typical modern poultry establishment in Colombia -- as in the United States -- has several thousand birds. Production is modern and efficient. A program to establish small enterprises as supplements to coffee production is being developed for both production and marketing of eggs in the Caldas area. A key consideration is that it seems feasible to have a poultry enterprise of only a little over a thousand birds without compromising efficiency of production. Then, as conditions permit, such a unit can be doubled, tripled, and so forth to permit expansion in production. Such an enterprise has various other advantages. The technology is well developed, and thoroughly tried in Colombia; it is not too complicated, and can be readily supervised in connection with the sale of feed or the purchase of the product from the farmers.

Expansion is already underway. The margin between prices of broilers and costs of production under efficient management appears to be unusually broad. It should be noted that modern poultry and egg enterprises are very non-traditional and have little relation to the management of a farm flock of 15 or 20 chickens. It seems quite likely that the traditional farmer, such as the coffee grower, will need special advice and supervision both in production and marketing if he is going to be competitive. As stated earlier, an effort is being made to provide such help in the Caldas area.

In summary, expanding traditional production into nontraditional lines, where prospects are more promising, is a difficult step. The door is not completely closed, but special assistance will be required to accelerate the shift into the limited number of products in which entry appears feasible.

Problems in Accelerating Production

Now that we have considered expansion in agricultural production by various types of farmers and for various groups of crops, let us turn to more general problems of agriculture as an industry in Colombia.

What seem to be the greatest impediments to agricultural development, or more specifically, to an acceleration in agricultural production and income? There is not any single impediment or even any small group that is restraining development. Deficiencies within the farm, outside the farm, in the community, and in the nonfarm sector all have constrained development. The need to develop marketing simultaneously with production seems well established. Even the farmer who is within a quarter of a mile from a road on which wheeled vehicles

can bring in fertilizer, take out products to be marketed, and reduce his isolation has limited flexibility and strong impediments to expansion of production. The rural educational effort is so inadequate as to be both a general restraining influence and a specific one that provides insufficient training in basic skills (functional literacy). Access is limited to the elementary and intermediate schooling that is the prerequisite to additional training required to develop the management and leadership qualities which are a basic shortage in the modernization or transformation of agriculture. The growing total of children who are too numerous to be well nourished, educated, and employed in turn is another focus for attention. The solution of the per capita production and income problem is not limited to increasing total production.

Although a broad range of influences limit agricultural development, it is believed appropriate for this report to consider specific limitations directly related to farm production. It should be clear that these limiting factors are not considered more vital or important than others. Neither are they regarded as strategic or crucial impediments blocking the whole wheel of progress, since many of the other spokes also seem to need attention. On the other hand, some countries with all these problems have had real break-throughs in agricultural development. The high-response grain varieties have yielded high incremental returns and have been eagerly adopted even by small farmers despite various limitations such as lack of education and previous record of slowness to change from traditional practices.

Role of Improved Inputs

The transformation of agriculture from a relatively traditional to a relatively modern, progressive production process may be visualized in terms of inputs and outputs. In this restricted sense, the problem of slow development results from the limited use of more productive inputs. A primary responsibility for solutions to these remediable deficiencies lies with the Government.

According to calculations made in chapter 2, about half of the 3.3-percent average annual rate of increase in agricultural production between 1950 and 1967 was attributable to increased inputs, and half represented higher output per unit of total inputs; that is, increased productivity.

Bruton has found that for Latin American countries including Colombia, productivity gains for the entire economy tend to be independent of the change in employment of the various inputs, classified broadly (8, pp. 1099-1116). In other words, productivity increases have been about as rapid when more inputs of capital and labor have been used as when such inputs have shown little or no increase. In addition, the apparent productivity gains were largely due to a greater utilization of capacity and were not "true" productivity gains.

For agriculture, the calculation of productivity is based upon a more detailed classification of inputs (into five groups). Those being considered to increase productivity are even more detailed. They are the nontraditional inputs of fertilizers, improved seeds, pesticides, herbicides, and, by implication, improved management. Available estimates suggest that the quantity employed is directly related to productivity gains, although it is not essential

that each of the inputs be profitable if used alone in an otherwise unchanged production situation. The whole production process appears to be quite different with the employment of nontraditional inputs. The transformation from traditional to nontraditional farming requires a shift in cultivation and management practices. Indeed, it seems probable that the nontraditional inputs are essential elements of the transformation, encouraging the learning and adaptation that are a part of the more productive farming process.

The varied advance in crop yields in Colombia appears to be associated with the extent of use of fertilizer; improved seeds; control of weeds, disease, and insects; improved cultivation; and modern techniques of soil and water management. It seems clear that these inputs must be expanded if crop yields are to accelerate. A minimum effort to overcome the greatest deficiencies in agricultural production might concentrate on expansion of inputs of a complementary character, such as fertilizers, better seeds, and chemicals to control weeds, insects, and diseases. Each of these has received considerable attention in Colombia, but the possibilities of the combination of improved seed and fertilization have been explored only to a limited extent. Nevertheless, Colombia has a firm basis for supplying larger quantities of each of these inputs, with only limited requirements for foreign exchange. A long and distinguished program of plant genetics and seed development has resulted in improved varieties which form the basis for accelerating seed multiplication and more general usage for the principal commercial crops. Investment has already been made in fertilizer plants with a capacity well beyond the achieved rate of production, and additional capacity is being installed.

Expansion in Cropland

The use of more fertilizer, improved seeds, and more chemicals for insect, disease, and weed control is all related chiefly to increasing production per hectare or per animal. In the past, half of the increase in agricultural production in Colombia has been attributable to increased acreage planted for crops, and increased and somewhat improved pasture for livestock. Improvement in the efficiency of production need not conflict with the continuation of expansion in acreage in cultivation and in pasture. There are three substantial sources of additional cropland, the exploitation of which may require only moderate resources from the Government. The first is a few fertile river valleys, not yet developed, which will require some improvement, often drainage, and some infrastructure. The second is extensive areas of fertile flatland, in regions with good transportation. Much of this land is now in pasture. The biggest and most conspicuous area is the estimated 30 percent of the Valle del Cauca still in pasture. The third source of additional cropland is the vast eastern plains (Los Llanos Orientales), which are now more habitable because of advances in disease control and more accessible because of improved means of transportation, including one or two important new bridges. These areas are being mapped, and their agricultural potentialities are being assessed. Limited, preliminary trials are being made of soil amendments needed for crop and pasture development. In general, modern methods of soil management tend to partially overcome the worst defects of tropical soils and make them more productive and more profitable. Enough general knowledge is available to make the long-term development of the Llanos seem probable, but the specific information needed for practical application has just begun to accumulate from limited field trials.

Short-Term Versus Long-Term Needs

A program to increase the use of nontraditional inputs is appropriate for short-term needs. The longer term need is for more research and development, since new varieties are always required to keep ahead of insects and disease, and, realistically, to keep pace with progress elsewhere. When other countries, even developed ones, make progress in improving production and reducing costs, Colombia loses ground in a very real sense if comparable advances are not made there. For example, if a Colombian product is being sold abroad in competition with products from other countries, the loss to Colombia will be direct and prompt, for international prices will decline as a result of lower costs of production elsewhere.

Improvements in production through the increased use of nontraditional inputs would neglect a series of general problems. These include the problems of mechanization, agrarian reform in the most general sense, the development of research and of other agricultural institutions, and the need for infrastructure. There is no implication that this group of problems is less important than persuading farmers to increase the use of nontraditional inputs.

In a slightly different category is the problem of marketing. If there is any substantial success in accelerating the growth in agricultural production beyond the rate of growth of population, the present marketing system -- which is more or less geared to present levels of production -- will require reorganization and improvement. Accordingly, an increase in production will require a simultaneous improvement in marketing. Moreover, such an improvement will be an important and perhaps essential condition for obtaining expansion in production. As indicated above, a producer will be reluctant to increase production if he expects an adverse price reaction on a thin local market. Without an effective market, producers have little incentive to expand.

Who Will Benefit?

Who will benefit most from such a program to increase the use of non-traditional inputs? It has been indicated that the farming operations with the greatest flexibility for expansion are the larger ones that utilize mechanical equipment and relatively modern technology on fertile, generally level land in or near well-developed areas and that grow selected crops of groups 5 and 5A. Farmers with such operations are likely to be the first to benefit from a general program to increase nontraditional inputs. However, for this group, subsidization is neither needed nor defensible. If inputs are not subsidized for them, there can be no objections on the basis of equity if these large farmers use more and better inputs to increase production. Because of the many disadvantages under which the small, traditional farmer is operating, his participation in the use of nontraditional inputs to expand output will require special attention and help. This would include the possibility of special subsidies for the introduction of improved practices. Indeed, such a policy may be tailored to fit specific needs and can be the means of helping small farmers to adopt improved practices and to purchase the inputs required by new technology. Thus, to the extent desirable, a compromise can be made between "productive" efficiency and equity in the allocation of resources for agricultural programs. A plan for these purposes could be quickly adopted while longer term, but no less important, remedies were being sought in both rural and urban areas.

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